D.G.O. 9. 49 C
300

GOVERNMENT OF INDIA

METEOROLOGICAL DEPARTMENT

INDIA WEATHER REVIEW, 1949

ANNUAL SUMMARY

PART C

STORMS AND DEPRESSIONS

CONTENTS

Published by the Authority of the Government of India

Under the Direction of

Dr. S. C. Roy, D.Sc. (London)

Director General of Observatories

PRINTED IN INDIA, BY THE MANAGER, GOVT. OF INDIA PRESS, NASIK ROAD.
PUBLISHED BY THE MANAGER OF PUBLICATIONS, DELHI: 1954

Price : Rs. 2/14/- *or* 4*sh.* 6*d.*

National Oceanic and Atmospheric Administration

Environmental Data Rescue Program

ERRATA NOTICE

One or more conditions of the original document may affect the quality of the image, such as:

Discolored pages
Faded or light ink
Binding intrudes into the text

This document has been imaged through the NOAA Environmental Data Rescue Program. To view the original document, please contact the NOAA Central Library in Silver Spring, MD at (301) 713-2607 x124 or www.reference@nodc.noaa.gov.

Information Manufacturing Corporation
Imaging Subcontractor
Rocket Center, West Virginia
September 14, 1999

INDIA WEATHER REVIEW, 1949

ANNUAL SUMMARY

PART C

STORMS AND DEPRESSIONS

INDIA WEATHER REVIEW, 1949

ANNUAL SUMMARY

PART C

Storms and Depressions

I. DEPRESSIONS AND CYCLONIC STORMS

During the year one storm and 9 depressions formed in the Bay of Bengal, one depression in the Arabian Sea and three depressions over land. The storm developed in the Bay of Bengal between the 20th and 31st October 1949 and the greatest barometric depth in it was probably about 30 mbs.

The detailed descriptions of the storms and the depressions are, as usual, followed by a list of western disturbances of the year, of the more important local storms and of the localities in which winds of force 9 or more unconnected with storms were experienced by ships in the Indian Seas.

1. Deep depression of 22nd to 24th April 1949 in the Bay of Bengal.—On the evening of the 18th April, S.S. Malaga near Lat. 09°N., Long. 93°E. was reporting northwest wind of 13 knots and S.S. Duxbury Bay at Lat. 06°N, Long. 91·8°E. was reporting north-northwest wind of 15 knots, overcast skies and rain showers. Victoria Point was at that time experiencing easterly winds. These indicated that conditions were unsettled in the south Andaman Sea. The unsettled conditions shifted westwards during the course of the next 36 hours and, on the 21st morning, a well-marked trough of low pressure was lying over the southeast Bay of Bengal and the neighbourhood. By that evening, the upper winds over Port Blair had strengthened to 20 to 25 knots 3,000 ft. a.s.l. and were blowing from south and southsoutheast. These winds strengthened further in the course of the night and were blowing from south with speeds of 30 to 40 knots at 2,000 and 3,000 ft. a.s.l. on the 22nd morning, when a depression probably deep, had formed with its centre near Lat. 12°N, Long. 90°E. The veering of Port Blair upper winds to westsouthwest and their further strengthening by that evening indicated that the deep depression had moved northeastwards. It was centred at 1730 hrs. I.S.T. of 22nd near Lat. 13½°N, Long. 92°E. The deep depression thereafter moved northnortheast and was centred at 0830 hrs. of 23rd near Lat. 16½°N., Long. 93°E. At that time S.S. Karoa at Lat. 17½°N., Long. 93½°E. was experiencing southeast winds of 30 knots and squally weather. The deep depression then gradually weakened while moving northnortheast and lay close to the coast between Akyab and Sandoway on the 23rd evening. By the next morning (24th) it had crossed the coast and moved away into Burma.

2. Depression of 21st to 25th May 1949 in the Bay of Bengal.—Ships' observations from the south Bay of Bengal and the upper winds along the east coast of the Peninsula on the 20th morning indicated the existence of a well-marked trough of low pressure over the southwest Bay and the adjoining areas of the southeast Bay. By the next morning, the trough had shifted westwards and was lying off the Coromandel coast and had become more pronounced; the coastal winds had come under the grip of the cyclonic circulation upto 5,000 ft. a.s.l. and the upper winds over Port Blair had veered to south. A depression was probably forming at that time with its central region near Lat. 11½° N., Long. 84°E. By the same evening (*i.e.*, by the evening of the 21st) the depression was well-formed and was centred near Lat. 12° N., Long. 83° E. Stations along the north Coromandel-south Circars coast had started raining and the upper winds along the Madras coast and in Ceylon had strengthened further. The depression moved northwest and was centred on the 22nd morning near Lat. 13½° N., Long. 81½° E. The depression then began to weaken and lay close to the coast south of Nellore on that evening. Crossing the coast during the night, it lay as a low pressure area over the Madras Deccan on the 23rd morning and moved away westwards as a low pressure wave emerging into the Arabian Sea on the 24th.

The formation and movement of this depression was responsible for the advent of the monsoon into the extreme south of the Bay by the 22nd of May, for widespread and locally very heavy rain along the Coromandel-south Circars coast on the 23rd and fairly widespread rain over the whole of the Peninsula from the 21st to 25th. The depression also carried the monsoon into the southeast Arabian Sea and into Malabar where heavy rain was recorded on the 23rd morning. Some of the noteworthy falls were, Minicoy 8″, Mangalore 7″ and Calicut 7″ on 23rd.

3. Shallow depression of 28th to 29th May in the Bay of Bengal.—On the morning of 27th May, the upper winds along Orissa-Bengal coast at 3,000 ft. a.s.l. and at higher levels indicated the extension of the seasonal trough of low pressure into the north Bay of Bengal. With the fall of pressures over the area and the appearance of a cyclonic circulation in the northeast Bay on the evening of 28th, it was evident that the trough of low pressure had concentrated into a shallow depression, with its centre at 1730 hrs.

I.S.T. near Lat. 20° N., Long. 91° E. The depression moved northeast, crossed the Arakan coast between Cox's Bazar and Akyab by the next morning (29th). It weakened thereafter and moved away northeastwards. In association with the formation and movement of the depression, maritime air penetrated into the Arakans, inland Burma, Eastern Pakistan and Assam. Widespread and locally heavy rain occurred in the Arakans between 28th and 30th and in Eastern Pakistan and Assam between 29th and 31st. Akyab reported 6″ and Kyaukpyu 5″ on the morning of the 29th. A few noteworthy district averages of rainfall and particularly heavy falls are also given below:

TABLE 1

Province and District	District averages on 30th	Particularly heavy falls
Manipur	3·5	
Lushai Hills	2·4	
Darrang (Assam)	..	Boreli 6·1″ on 30th.

4. Trough of low pressure from 23rd May to 29th May and deep depression of 30th May to 1st June in the Arabian Sea.—With the advance of the monsoon into southeast Arabian Sea brought in by the depression described above, a trough of low pressure appeared off the Konkan coast on the 23rd morning. The low pressure wave associated with the depression emerged into the Arabian Sea on the 24th morning and accentuated the trough which became well-marked on the 25th morning. The upper winds were gripped into the cyclonic circulation upto 10,000 ft. At 3,000 ft. a.s.l., Mangalore was reporting westsouthwest wind, 20 knots, Vengurla southsoutheast 30 knots and Poona, east, 10 knots. The trough continued to be marked for the next two days while shifting slightly westnorthwest. It became more pronounced by the evening of the 29th and on the 30th morning, a depression, apparently deep, formed with its centre near Lat. 18° N., Long. 70° E. S.S. Badarpur at Lat. 18½° N., Long. 70½°E., was reporting southerly wind of 30 knots while S.S. Orna at Lat. 18¼° N., Long. 69½° E., was experiencing northerly wind of 20 knots and squally weather. The deep depression slowly moved northwest apparently intensifying at the same time and on the 31st morning it was centred near Lat. 19° N., Long. 69° E. The observations of S.S. Jalamohan, Jalagopal and Stanvae definitely indicated that the disturbance was a deep depression, if not a cyclonic storm, on the morning of the 31st. Jalagopal in the northeast sector at Lat. 20½° N., Long. 69½° E., was experiencing easterly wind of 25 knots; Stanvae in the southwestern sector at Lat. 17½°N., Long. 68½°E. was having westnorthwest wind of speed 35 knots while Jalamohan in the southeast sector at Lat. 17¾° N., Long. 69½° E., was reporting southwest wind of 10 knots. All these ships reported rain as present weather. The deep depression thereafter moved away northwestwards and rapidly weakened and became unimportant. The trough, however persisted off the Konkan-Kathiawar coast, till the 2nd June and then filled up.

Under the influence of this trough and the developments within it, the early advance of the monsoon on Malabar coast was maintained and the monsoon extended into the Konkan and temporarily into Gujarat also towards the end of May. It was vigorous off the Konkan on the 29th and 30th. Bombay experienced strong winds from south and southeast on the 29th, 30th and 31st with wind speed reaching 40 to 50 m.p.h. in gusts.

5. Shallow depression in the Bay of Bengal from 8th to 14th June, 1949.—The monsoon had advanced into the north Bay of Bengal by the 7th of June and an upper air trough at 3,000 ft. a.s.l. and above extending over the north Bay of Bengal and West Bengal appeared by the evening of that day. On the 8th morning, a shallow depression could be located in the northwest angle of the Bay of Bengal centred between Sandheads and Balasore. The depression crossed the coast during the following night and was centred between Cuttack and Balasore at 0830 hrs. of 9th. It then moved northeastwards and lay over south Bihar and Gangetic West Bengal on the 10th morning with its centre near Naya Dumka. The depression persisted over the same region except for a slight northward movement during the next 3 days and became unimportant by the 14th.

Under the influence of this depression, the monsoon advanced into northeast India. Locally very heavy rain occurred in Chota Nagpur on the 10th and 11th, in Bihar on the 12th and 13th and in sub-Himalayan West Bengal and Assam on the 12th. The noteworthy district averages of rainfall and the particularly heavy amounts are set out in the following table.

TABLE 2

Province and District	District averages on 10th	11th	12th	13th	14th	Particularly heavy falls
Bihar						
Muzaffarpur			2·7	2·7	..	Bowarah 6·4″ on 12th; Mahuva 6·2″ on 13th.
Darbhanga			..	..	..	Khutana 8·1″ on 14th; Samastipur 8·1″ on 13th; Darbhanga Obs. 5·7″ on 13th; Behera 6·0″ on 12th; Dalsinghsarai 5·8″ on 12th.
Monghyr		2·4	4·7	3·3	..	Gidhaur 14·5″ on 13th; 12·7″ on 12th; Begusarai 9·0″ on 14th; Sagrampur 8·5″ on 12th; Chaika Bamda 8·3″ on 12th; Kharaghpur 7·7″ on 11th; Shaikhpur 6·2″ on 13th; Begusarai 6·0″ on 13th; Jamalpur 5·4″ on 12th.
Bhagalpur			..	..	..	Amarpur 6·8″ on 12th.
Saharsa			..	..	..	Supal 6·3″ on 10th.
Purnea			..	..	..	Kishangang 5·1″ on 29rd.
Santhal Parganas.			..	..	..	Jamutra 10·8″ on 12th; Modhaipur 8·1″ on 11th; Deoghar 7·6″ on 12th.
Hazaribagh			..	..	..	Pachamba 11·8″ on 12th.
Manbhum			..	..	..	Jaldah 6·7″ on 10th; Tundi 6·7″ on 12th; Chundil 6·2″ on 11th; Borabatar 5·7″ on 10th; Bhugnumdi 5·2″ on 10th.
Assam						
Khasi and Jaintia Hills. ..		2·7	6·1	..	..	Cherrapunji 12·9″ on 12th.
Abhor Hills .	2·7	..	..	..	..	
Tripura Hills			..	..	..	Sabroom 5·2″ on 10th.
West Bengal						
24 Parganas			..	..	..	Gosaba 6·2″ on 10th.
Darjeeling . ..		2·0	2·4	..	..	
Bankura			..	..	..	Taldangra 8·0″ on 10th.

6. Unsettled conditions in the Bay of Bengal between the 3rd and 5th July 1949.—Weather became unsettled in the north Bay of Bengal on the 3rd and a low pressure wave moved from there into Gangetic West Bengal on the 5th; on the 6th morning, a shallow low lay over northeast Central Provinces and the adjoining areas of the east United Provinces and Chota Nagpur. Moving westwards, the low became unimportant over the southwest United Provinces and Madhya Bharat by the 8th. Under its influence, the monsoon extended into the east United Provinces and Vindhya Pradesh on the 6th, into the west United Provinces, the East Punjab Hills, Madhya Bharat and East Rajputana on the 7th, and into west Rajputana and Gujarat by the next day. The shallow low was also responsible for a strengthening of the monsoon in the Central Provinces between the 3rd and 6th.

7. Shallow Bay depression of 13th to 15th July 1949.—The seasonal trough of low pressure extended into northeast Bay of Bengal on the morning of 10th July and by the next morning, the trough had become more marked in north Bay where a cyclonic circulation extending upto 10,000 ft. a.s.l. was clearly noticeable in the upper air. Conditions remained more or less unchanged till the 13th morning when a shallow depression formed off the Orissa coast with its centre near Lat. 19°N., Long. 86½°E. Ships in the southwestern sector of the depression off the north Circars coast were experiencing at that time, winds of 30 knots or more. The depression moved slowly northnortheastwards and was centred at 0830 hrs. I.S.T. of 14th near Lat. 20½° N., Long. 87½° E. It then moved westnorthwest, crossed the Orissa coast during the night of the 14th, and lay as a low pressure area over Orissa on the morning of the 15th. The low became accentuated by the movement of another low pressure wave from the north Bay of Bengal and moved westnorthwestward upto 17th. It then became unimportant.

Under the influence of these developments, the monsoon strengthened considerably along the west coast of the Peninsula and remained active over the central parts of the country and northeast India.

8. Land 'low' of 22nd to 26th July 1949.—The axis of the seasonal trough was lying near the foot of the Himalayas from the 20th of July and widespread and locally heavy rainfall was confined to northeast India outside Orissa, the United Provinces and the East Punjab. On the 22nd morning, the axis showed a tendency to shift southwards and a shallow "low" appeared over Bihar and the adjoining areas of Gangetic West Bengal with central region near Naya Dumka. The low moved westwards and lay over southeast United Provinces and Vindhya Pradesh on the 23rd morning with central region between Sutna and Allahabad. On the next morning, the low lay over north Madhya Bharat and southwest United Provinces with its centre between Jhansi and Gwalior. It moved into southeast Rajputana by the 25th morning and lay with its central region about 100 miles northeast of Kotah. It then took a northwesterly course and lay over southwest Punjab at 0830 hrs. I.S.T. of 26th. It merged in the seasonal low by the morning of the 27th.

In association with this low, rainfall increased in the central parts of the country and the monsoon revived in the western half of the Peninsula, Gujarat, Saurashtra and east Rajputana.

9. Depression in the Bay of Bengal from 1st to 3rd August 1949.—On the morning of 26th July, pressures were falling over and around Central Burma where a shallow low was noticed on the sea level chart, and a cyclonic circulation was also noticeable in the lower levels in the upper air, Moving northwestwards, the low emerged into the north Bay on 28th and passed inland across Orissa-Bengal coasts on 29th. The passage of this low pressure wave accentuated the seasonal trough of low pressure which continued to extend over the north Bay.

On the morning of the 30th July, the upper winds at 5,000 and 7,000 ft. a.s.l. over Chittagong became northeasterly and, on the same evening, an area of pressure defect appeared over central Burma. These suggested that a low pressure wave from the east was moving towards Arakan coast. By next morning, the low pressure wave had moved into the north Bay of Bengal where conditions became markedly unsettled. The unsettled conditions developed into a depression which was centred at 0830 hrs. I.S.T. of 1st August near Lat. 20°N., Long. 88°E. Moving northwestwards without any appreciable intensification, the depression crossed the north Orissa coast by the early morning of the 2nd and lay at 0830 hrs. I.S.T. of that day as a low pressure area over north Orissa and Chota Nagpur with its central region about 80 miles northeast of Sambalpur. On the 3rd morning, it had weakened further and lay as a feeble low centred between Saugor and Nowgong. Thereafter it became unimportant.

Associated with the formation and movement of this depression, there was widespread rain in West Bengal, Bihar and Chota Nagpur between the 31st of July and 2nd of August and in Central Provinces and Madhya Bharat from the 1st to the 3rd.

The noteworthy district averages of rainfall and particularly heavy falls associated with the depression are given in the following table:

TABLE 3

Province and District	District averages on					Particularly heavy falls
	1st	2nd	3rd	4th	5th	
West Bengal						
Howrah	2·1	..	..	..	..	
Bihar						
Sahabad	..	..	..	..	2·2	Dehri 7·2″ on 5th; Mahania 7·1″ on 4th; Baswan 6·7″ on 5th.
Polaman	..	..	..	2·2	..	
Central Provinces						
Bilaspur	..	..	2·1	..	2·0	
Raigarh	..	..	..	..	2·2	
Saugor	..	..	..	..	..	Banda 5·1″ on 3rd; Garhakota 5·7″ on 4th.
Mandla	..	..	2·4	..	..	
Balaghat	..	2·1	..	..	..	Dhuti 5·1″ on 2nd.
Chindwara	..	2·1	..	..	..	Bori 6·6″ on 1st; Roomal 5·7″ on 3rd.

10. Land depression of 2nd to 4th August 1949.—On the evening of the 1st, a shallow low pressure area appeared over south Rajputana and the adjoining areas of lower Sind and Kutch. The 'low' persisted over the same region and by the evening of the 2nd, the associated cyclonic circulation became well-marked upto 5,000 ft. a.s.l. The pressures continued to fall over the region. On the morning of the 3rd, Bhuj was having a negative pressure departure of 6·4 mbs. By the same evening the low pressure area concentrated into a depression with its central region near Umarkot and the monsoon had strengthened considerably in

northeast Arabian Sea and the Gulf of Kutch. Dwarka reported winds of 40 knots and Jamnagar 35 knots at 1730 hrs. I.S.T. of 3rd. The depression weakened without appreciable movement during the night and the residual low moved northwestwards to upper Sind by the 4th and from then northeastwards into southwest Punjab by the 5th. It became unimportant by the next day.

Under the influence of this land depression, vigorous monsoon conditions prevailed in Kutch and Saurashtra from 1st to 3rd August. The noteworthy district averages and particularly heavy amounts of rainfall recorded during the period are given in the following table:

TABLE 4

Province and District	District averages on				Particularly heavy falls
	1st	2nd	3rd	4th	
Panch Mahal	..	..	..	2·8	Kalol 5·4″ on 4th.
Surat	..	2·1	2·7	..	Pardi 6·2″ on 3rd.
Ratnagiri	..	..	..	..	Mandangarh 6·2″ on 1st.
Kolaba	..	..	..	..	Matheran 7·6″ on 2nd.
Junagarh	..	..	..	..	Junagarh 6·1″ on 2nd.
Saurashtra	..	..	..	..	Bantwa 5·5″ on 2nd.
Kutch	..	..	..	..	Bhuj 6·1″ on 3rd.

11. Low Pressure wave from the Bay of Bengal between the 5th and 10th August 1949.—A low pressure wave moved inland from the northwest angle of the Bay of Bengal on the 5th August and lay as a low over Bihar on the 6th. The low persisted with slight variations in position and intensity till the 10th August. In association with these conditions, the monsoon was active generally in northeast India, east United Provinces and in and near the hills of west United Provinces and the east Punjab from the 5th to 10th, locally heavy rain being reported from the hills of west United Provinces on the 9th.

12. Bay of Bengal depression of 7th to 10th September 1949.—The seasonal trough of low pressure extended into the north Bay of Bengal on the morning of the 4th when pressures were also falling along the Orissa-Circars coast and in the west central Bay. Pressures continued to fall over these areas for the next two days. By the morning of the 7th, a cyclonic circulation extending upto 10,000 ft. a.s.l. had established itself over the northwest and west central Bay of Bengal and a shallow depression had formed with its central region near Lat. 19°N., Long. 87°E. S.S. Maharaja in the southeastern sector of the depression reported squally weather and moderate continuous rain on the 7th morning indicating the strengthening of the monsoon. The depression moved slowly northwestwards and was centred at 0130 hrs. I.S.T. of 8th near Lat. 19½°N., Long. 86½°E. It crossed the Orissa coast near Puri during the early morning of the 8th and was centred close to the coast inland at 0630 hrs. I.S.T. of that day. Continuing to move northwestwards and weakening at the same time, it lay on the 9th morning as a low pressure area over the Central Provinces, with its central region between Seoni and Pendra. The 'low' shifted to northwest Central Provinces and the adjoining parts of Madhya Bharat by the 10th morning. Weakening further thereafter it merged in the seasonal trough of low pressure by the 11th.

In association with this depression, widespread rain occurred in Orissa and the north Circars coast on the 8th and over the region extending from the north Konkan and Gujarat, to Orissa on the 9th and in Madhya Bharat,. Gujarat, north Konkan, and the Central Provinces on the 10th. Rainfall was locally heavy in Madhya Bharat. The noteworthy district averages and particularly heavy amounts of rainfall are given below:

TABLE 5

Province and District	District averages on						Particularly heavy falls
	6th	7th	8th	9th	10th	11th	
Bombay							
Kaira	..	..	..	..	..	2·1	
Broach	..	..	..	..	..	..	Hansot 6·4″ on 10th.
Panch Mahal	..	..	..	..	2·3	..	
Surat	..	..	..	..	3·3	2·5	Chikhli 7·4″ on 10th; Pardi 6·8″ on 11th; Jalalpur 5·5″ on 10th.
Bombay	..	..	..	..	2·8	..	
Ratnagiri	2·8	..	..	..	..	..	
Central Provinces							
Drug	..	..	..	2·7	..	..	Khapari 6·8″ on 9th; Selod 6·1″ on 9th.
Balaghat	..	..	..	2·1	..	..	
Hoshangabad	..	..	..	..	..	..	Pachmarhi 7·2″ on 6th; Mohpani 6·9″ on 8th.
Chindwara	..	..	..	3·1	..	..	

13. Shallow depression in the Bay of Bengal between 13th and 21st September 1949.—On the morning of the 11th of September, the seasonal trough of low pressure over the Gangetic plain was extending into the head of the Bay of Bengal. Pressures fell over the north Bay during the subsequent 2 days and, by the morning of the 13th, a shallow depression formed in the northwest angle of the Bay with its central region at 0830 hrs. I.S.T. midway between Chandbali and Sandheads. The shallow depression crossed the coast in the same afternoon between Chandbali and Balasore and, moving westnorthwestwards, lay as a low pressure area over North Central Provinces on the morning of the 14th. It persisted there without much variation in its position and intensity during the next 24 hours. Then there was a concentrated fall of pressure in west Central Provinces and Madhya Bharat and a sharp rise of pressure all around that area. As a result the low pressure area intensified again into a depression which lay centred at 0830 hrs. I.S.T. on the 16th near Jubbulpore. Moving northwestwards thereafter, the depression lay centred midway between Guna and Saugor on the 17th morning, near Gwalior on the 18th morning and about one hundred miles northnorthwest of Jaipur on the 19th morning. It then began to weaken and finally merged in the seasonal low over Rajputana and Western Pakistan on the 21st.

In association with this depression, the monsoon was strong in the west Central Provinces and Madhya Bharat and fairly active in Vindhya Pradesh between the 15th and 18th and strong in the west United Provinces on the 18th and 19th. The heavy rains in and near the Vindhyas during this period are reported to have caused floods in the Tapti river.

14. Deep depression in the Bay of Bengal from 18th to 23rd September 1949.—The approach of a low pressure wave from lower Burma towards the Andaman Sea was noticeable on the charts of the 15th evening when pressures were falling in and around Tenasserim. By the morning of the 17th, the low pressure wave had moved into the north Andaman Sea. Tavoy reported 5·0″ of rain on the 17th morning. By the evening of the same day, a shallow low formed in the north Andaman Sea with its central region at 1730 hrs. I.S.T. near Lat. 14° N., Long. 94° E. This low moved northwestwards and lay as a depression centred on the evening of the 18th near Lat. 16° N., Long. 93° E. Rapidly intensifying into a deep depression and moving westnorthwest, it was centred at 0830 hrs. I.S.T. of 19th near Lat. 16½° N., Long. 90½° E. The deep depression thereafter moved practically westwards, rather rapidly, and lay on the 20th morning with its centre near Lat. 16½° N., Long. 85½° E. Ships in the southern sector of the depression were experiencing heavy continuous rain at that time. Rainfall had also occurred over most of the Peninsula and been heavy in Malabar. The deep depression was centred at 1730 hrs. I.S.T. of 21st about 70 miles to the eastsoutheast of Cocanada. It probably intensified into a cyclonic storm of small extent in the course of the night. At 0830 hrs. I.S.T. of 21st it was crossing the coast between Cocanada and Masulipatam. The latter station was having a negative pressure departure of 13·6 mbs. at that time. After crossing the coast the deep depression was centred about 70 miles northwest of Masulipatam on the 22nd morning. Weakening rapidly and moving northwestwards, it lay as a low over northwest Hyderabad on the 23rd morning and thereafter moved away northeastwards as a low pressure wave.

The remarkable feature about this depression was the concentrated heavy rainfall over a narrow belt extending from the south Circars coast across the south Deccan to the north Konkan. Bombay had a phenomenally heavy rainfall of 32″ during 48 hours ending at 0830 hrs. I.S.T. of 23rd, out of which 23″ fell during a period of 12 hrs. on the 22nd. Very heavy falls were also recorded along the north Madras coast, south Deccan and the south Konkan on the 20th, in the west Deccan and north Konkan on the 21st and in Berar on the 22nd. The heavy rains in the Bijapur area is reported to have resulted in serious losses to property and livestock and hardship to the people, while, in the Bombay city, communications and transport were completely paralysed for 36 hours.

The noteworthy district averages of rainfall and the particularly heavy falls associated with this depression are given below:

TABLE 6

Province and District	District averages on 20th	21st	22nd	23rd	Particularly heavy falls
Bombay					
Surat	..	..	..	2·9	Bardoli 5·2″ on 23rd.
Ahmednagar	..	..	..	2·4	Shrigonda 5·9″ on 22nd and 5·0″ on 23rd.
Poona	..	..	2·2	2·3	Dhond 5·9″ on 22nd and 5·1″ on 23rd; Lonavla 5·7″ on 22nd; Ghoda 5·3″ on 23rd.
Sholapur	..	..	4·3	..	Pandharpur 5·7″ on 22nd.
Satara	..	..	3·0	..	
Belgaum	..	..	2·1	..	Athani 5·0″ on 22nd.
Bijapur	..	2·7	4·7	..	Muddebehal 5·7″ on 22nd; Bijapur 5·7″ on 22nd; Begewadi 5·5″ on 22nd;
Thana	..	..	3·8	5·2	Mahim 9·0″ on 22nd; 8·7″ on 23rd; Thana 7·5″ on 23rd, Murbad 6·6″ on 23rd; Bassein 6·6″ on 23rd; 6·2″ on 22nd; Bhivandi 5·7″ on 23rd; Kalyan 5·1″ on 23rd.
Bombay	..	..	14·7	17·0	Bombay 17·0″ on 23rd and 14·7″ on 22nd.
Bombay suburb	..	..	6·5	..	Kurla 6·5″ on 22nd.
Kolaba	..	..	7·4	6·1	Alibag 16·1″ on 23rd; Alibag & Uran 12·1″ on 22nd; Panvel 8·8″ on 23rd; Roha 7·2″ on 22nd; Panvel 6·6″ on 22nd; Matheran 6·5″ on 22nd; 6·3″ on 23rd; Karjat 6·3″ on 22nd; Mahad 6·2″ on 23rd; Mangaon 6·0″ on 23rd; Pen 5·7″ on 22nd; Mangaon 5·1″ on 22nd; Roha 5·0″ on 23rd.
Ratnagiri	..	3·0	4·7	4·7	Mandangad 12·6″ on 23rd; Khed 9·2″ on 22nd; Dapoli 8·7″ on 23rd; Guhagar 8·0″ on 22nd; Chiplun 7·1″ on 23rd; Ratnagiri 7·0″ on 22nd; Mandangad 6·4″ on 22nd; Malvan 5·7″ on 21st; Guhagar 5·5″ on 21st; Khed 5·4″ on 21st.
Hyderabad					
Bidar	..	..	..	4·2	
Bir	..	..	..	3·6	Roti 6·0″ on 23rd.
Osmanabad	..	..	..	2·7	
Gulbarga	..	2·2	2·5	..	
Mahabubnagar	..	3·6	2·3	2·7	Mahabubnagar 5·3″ on 23rd.
Raichur	..	3·7	3·8	..	Raichur (Obsy.) 5·1″ on 22nd.
Central Provinces					
Yeotmal	2·0	..	..	..	Digras 5·1″ on 20th.
Madras					
Guntur	..	2·2	4·1	..	Vinukonda 10·4″ on 24th; Paddaganjanlock 9·9″ on 22nd; Intur lock 9·7″ on 22nd; Ongole 9·2″ on 22nd; Santasavur 8·7″ on 22nd; Nizampatnam lock 7·3″ on 22nd; Bapatla 6·9″ on 22nd; Kuchipudilock 6·7″ on 22nd; Chinaganjam 6·5″ on 22nd; Ponnur 5·6″ on 21st, Nalavada lock 5·3″ on 22nd.
Nellore	2·9	..	..	..	Kanigiri 5·7″ on 22nd; Pakala 5·5″ on 21st; Darsi 5·1″ on 22nd; Kavali 5·0″ on 21st.

TABLE 6—*contd.*

Province and District	District averages on 20th	21st	22nd	23rd	Particularly heavy falls
Cuddapah	2·1				Mydukur 6·4″ on 21st; Thanaballapalli 5·3″ on 22nd.
Bellary	2·0		2·1		Kosigi 5·3″ on 22nd; Adoni 5·0″ on 22nd.
Kurnool	3·2		4·5		Yellur 11·1″ on 22nd; Markapur 9·0″ on 22nd; Atmakur 8·1″ on 22nd; Thppayapalem 7·0″ on 22nd; Lockinsula 7·0″ on 22nd; Nandyal 6·8″ on 22nd; Yerragondapalem 6·8″ on 22nd; Siddapuram 6·5″ on 22nd; Allagada 6·5″ on 22nd; Koilkuntla 6·3″ on 22nd; Sunkesula 6·2″ on 22nd; Siddapuram 6·0″ on 21st; Nandikotkur 5·1″ on 21st.

15. Depression in the Bay of Bengal from 8th to 11th October 1949.—A low pressure wave moved westwards across central Burma and lay as a trough of low pressure extending from the northeast Bay of Bengal to the Andaman Sea on the morning of the 5th of October. The trough of low persisted without appreciable change of position for 24 hours. In the meantime, a strengthening of the monsoon in south Bay and Andaman Sea was noticed. Victoria Point reported 5″ of rain on the 6th morning. The trough gradually shifted westwards and concentrated at the same time. By 1730 hrs. I.S.T. of the 7th, a depression had apparently formed with its central region within a degree of Lat. 18° N., Long. 90° E. The depression moved westnorthwestwards and intensified during the course of the night. On the morning of the 8th, it lay as a deep depression centred near Lat. 18½° N., Long. 88°E. S.S. Bandra located near Lat. 18°N., Long. 85½°E. reported a northerly squall of 45 knots at 0830 hrs. I.S.T. of 8th. Rain had commenced by that time along the Orissa coast and by the same evening in the whole of Orissa and the east Central Provinces. The deep depression weakened before crossing the coast near Gopalpur on the 9th morning and lay as a low pressure area over north Hyderabad, the east Central Provinces and Orissa on the 10th. It persisted for two days and became unimportant by the 12th after inducing a well-marked trough of low pressure in the east Arabian Sea off the north Konkan-Kathiawar coast. The latter became unimportant without appreciable movement in the course of the next 2 days.

In association with the depression, there was widespread rainfall in West Bengal on the 9th, in Orissa between the 8th and 10th and in the Central Provinces between the 9th and 11th. Very heavy falls were reported from the Orissa coast on the 9th. Rainfall also extended into the north Konkan and the north Deccan on the 13th. The noteworthy district averages of rainfall and the particularly heavy falls are given in the following table.

TABLE 7

Province and District	District averages on 8th	9th	10th	11th	Particularly heavy falls
West Bengal					
Jalpaiguri					Buxa 7·8″ on 10th.
Orissa					
Balasore					Balasore 6·0″ on 9th.
Puri					Puri 6·2″ on 9th.

16. Severe cyclone in the Bay of Bengal from 20th to 31st October 1949.—With the movement westwards of a low pressure wave across south Burma, weather became unsettled in the Andaman Sea on the morning of the 20th of October. The surface winds on this morning were westerly over Sabang, southeasterly over Victoria Point, easterly over Tavoy and northeasterly over Port Blair. Victoria Point had recorded 5″ of rain during the 24 hours ending at 0830 hrs. I.S.T. of 20th. By the morning of the 21st, a shallow depression formed with its centre near Lat. 10° N., Long. 95°E. The depression intensified and by 1730 hrs. I.S.T. of 22nd, it became deep and was centred near Lat. 10° N., Long. 94°E. The upper winds over Port Blair had strengthened to 30 knots at 2,000 and 3,000 ft. a.s.l. The strengthening of the monsoon in the south Bay of Bengal at the same time was evident from the heavy continuous rain reported by Colombo. By the 23rd morning, Port Blair upper winds at 3,000 ft. a.s.l. had strengthened to 40 knots and ships in the southwest Bay of Bengal reported overcast skies and rain showers. The deep depression was centred at 0830 hrs. I.S.T. of 23rd near Lat. 10° N., Long. 93° E. Moving westnorthwestwards and intensifying at the same time, it was centred near Lat. 10½°N., Long. 91½°E., on the 24th morning and near Lat. 11½°N., Long. 90° E., on the same evening. By that time the monsoon had strengthened considerably in the west central Bay of Bengal also, and ships in the western sector as far away as 400 miles from the centre of the depression were experiencing heavy continuous rain. The upper winds along the east coast of the Peninsula had also come into the grip of the cyclonic circulation. The deep depression intensified into a cyclonic storm by 0830 hrs. I.S.T. of 25th when its centre was near Lat. 12°N., Long. 89°E. The storm moved northwest and was centred on the 26th morning near Lat. 14½°N., Long. 85½°E. S.S. Jalamatsya which was near Lat. 11°N., Long. 84°E. at 0830 hrs. I.S.T. of 26th reported westerly wind of 50 knots, and S.S. Karapara at Lat. 12°N., Long. 83½°E., reported westnorthwest winds of 35 knots and moderate continuous rain. The pressure departure at the centre of the storm was at that time not less than—15 mbs. Rain had commenced along the Orissa coast by the 26th morning. The storm rapidly intensified into a severe cyclone with a core of hurricane winds and was centred at 1730 hrs. I.S.T. of 26th within half a degree of Lat. 15°N., Long. 84½°E. Steamship City of Oxford which was located near Lat. 12½° N., Long. 84½° E., was experiencing westsouthwest wind of 70 knots heavy continuous rain and poor visibility at that time. Rain had also commenced along the Circars coast. The cyclone continued to move northwestwards and was centred on the 27th morning near Lat. 16° N., Long. 83° E. Heavy rain had fallen along the Orissa coast and rainfall had extended into the interior of Orissa and the east Central Provinces. At 1730 hrs. I.S.T. of 27th, Masulipatam reported NNW

wind of 40 knots and a negative pressure departure of 21·7 mbs. The centre of the cyclone was then near Lat. 16° N., Long. 82½°E. The winds at Masulipatam continued to increase in speed reaching 50 knots at 1930 hrs. I.S.T., 65 knots at 2230 hrs. I.S.T. and a maximum speed of 70 knots at 0230 hrs. I.S.T. of 28th. Thereafter the speed began to fall. The wind direction was northnorthwest from 2230 hrs. I.S.T. and backed to westnorthwest by 0230 hrs. I.S.T. of 28th and to westsouthwest by 0730 hrs. I.S.T. of 28th. Heavy rain which commenced at that station at 1830 hrs. I.S.T. of the 27th continued till 1230 hrs. I.S.T. of 28th and the station recorded 18½" of rain between 1730 hrs. of 27th and 0830 hrs. of 28th.

The cyclone crossed the coast between Masulipatam and Cocanada at about 0200 hrs. I.S.T. of 28th. The pressure deficiency at the centre of the cyclone at this stage might have been 30 mbs. After crossing the coast, the cyclone weakened rapidly into a deep depression and was centred about 70 miles eastsoutheast of Khammameth at 0830 hrs. I.S.T. of 28th. Curving in a northnorthwesterly direction and weakening at the same time, it lay as a depression centred about 50 miles to the east of Chanda on the 29th morning. The depression then curved northeastwards and, moving rapidly, lay over Vindhya Pradesh and southeast United Provinces with its centre about 50 miles to the southsoutheast of Banaras on the 30th morning. On the morning of the 31st, the depression lay over north Bihar and it became unimportant by the evening of the 31st. During its movement northeastwards from the Central Provinces to Bihar, the depression was responsible for widespread rain in east Central Provinces, Vindhya Pradesh, United Provinces, Chota Nagpur, Bihar and West Bengal. Rainfall was locally very heavy in Bihar on the 31st.

The fierce winds and heavy rains which accompanied the cyclone caused appalling destruction of life and property and indescribable sufferings to the people in Andhra Desa. A huge storm wave, which rose to a height of 10 to 15 feet, is reported to have swept over the entire coast of the West and East Godavari districts upto a distance of 4 to 5 miles inland and inundated a number of villages. Most of the houses were blown away, all trees uprooted and the ground was laid bare. The torrential rains caused heavy breaches along the roads and railway lines and completely paralysed the telegraph and telephone communications in the Kistna, Guntur, the West Godavari and East Godavari districts, while streams, canals and tanks became flooded and their banks breached. Special mention may be made here about the severe floods in the Budameru river in the Kistna District which rose to record level. According to reports, over 750 human beings and nearly 30,000 cattle perished, while approximately a million acres of crops and over a quarter million houses were either destroyed or severely damaged during the cyclone. The total losses were estimated at several crores of rupees.

TABLE 8

Province and District	District averages on												Particularly heavy falls
	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	
Madras													
Visakhapatnam	..	..	..	..	..	..	..	2·3	3·9	2·5	2·2	..	Pulaparti 12·7" on 29th; Bhumunipatnam 7·1" on 30th; Narasapatnam 6·9" on 29th; Pathapatnam 6.3" on 28th; Pundi 5·5" on 28th; Takkali 5.3" on 28th; Bobbili 5.2" on 29th; Pundi 5·8" on 27th; Yellamanchilli 5·2" on 30th; Thotapalle 5·0" on 29th.
Visakhapatnam (Agency)	..	..	..	..	..	..	..	..	4·8	5·1	..	..	Araku 7·2" on 28th; Chintapalli 8 2" on 29th; Thotapalle 5·0" on 29th.
East Godavari (Plains)	..	..	..	..	..	..	..	..	3.8	3.0	..	..	Chintapalli 10·3" on 28th; Prattipadu 10·4" on 29th; Biccavole 10·2" on 28th; Kakinada (Obs.) 7·3" on 29th; Peddapuram 7.1" on 29th; Vella Lock 6·6" on 29th; Yerrapotavaram Lock 6·5" on 29th; Chantapalli 6·5" on 29th; Allamur Lock 6·4" on 28th; Mukkamala 5·7" on 29th; Pithapuram and Kothapeta 5·6" each on 28th; Ramachandrapuram 5·6" on 29th; Peddapuram and Alamuru 5·3" each on 28th; Mondepulanka 5·1" on 29th; Kakinada 5·0" on 29th.
West Godavari	..	..	..	..	..	..	..	..	3·8	..	..	..	Sidhantam 8·1" on 20th; Narasapur 7.3" on 29th; Koduru 7·1" on 29th; Lakshmipalayam 7·1" on 28th; Pallacole 7·7" on 28th; Narasapur and Yelurpadu 6·0" each on 28th; Duvva 5·3" on 28th; Sidhantam 5 2" on 29th; Lakshmipalayam 5·1" on 27th.
Krishna	..	..	..	..	..	..	2·6	..	3·7	..	..	..	Masulipatnam 19·8" on 26th; Pandraka Factory 15·1" on 28th; Kothagudem 11·2" on 28th; Kamalapuram Lock 9.5" on 28th; Tidal Lock 9.0" on 28th; Avanigadda 8·8" on 30th; Puligedda 7.7" on 28th; Akkumaru Lock 7·0" on 28th; Gannavaram 6·5" on 28th; Vallurpalem Lock 6·5" on 28th; Pamarru Lock 6·4" on 27th; Manginapudi Factory 6·3" on 26th; Lakshmipuram Lock 6·1" on 27th; Cowtaram Lock 6·1" on 28th; Kodur 6·0" on 28th; Lakshmipuram Lock 5·7" on

TABLE 8—*contd.*

Province and District	District Averages on												Particularly heavy falls
	20th	21st	22nd	23rd	24th	25th	26th	27th	28th	29th	30th	31st	
													28th; Veeramki Lock 5·6″ on 28th; Guruvindapalli Lock 5·6″ on 28th; Nedumole Lock 5·4″ on 28th; Pandraka Factory 5·1″ on 29th; Nuzvid 5·0″ on 28th; Nimmageda Lock 6·3″ on 28th.
Guntur . . .	..	..	..	..	..	..	..	..	2·9	..	..	..	Kallur Lock 9·6″ on 28th; Kuchipudi lock 7·6 ″on 28th; Repelle 7·3″ on 28th; Nallamala Lock 7·3″ on 28th; Guntur 7·2″ on 28th; Commanur lock 6·9″ on 28th; Morotha Lock 6·3″ on 28th; Vellatur Lock 6·2″ on 28th; Ravendrapad Lock 6·1″ on 28th; Tenali 5·7″ on 28th; Nizampatnam Lock 5·6″ on 28th; Jagarlamudi Lock 5·4″ on 28th; Intur lock 5·3″ on 28th.
Hyderabad													
Warangal . . .	..	..	..	..	..	..	..	..	..	..	..	..	Wyra 6·9″ on 28th; Narsampet 6·5″ on 29th; Mulerg 5·5″ on 29th.

II.—WESTERN DISTURBANCES

During the period February to May, the weather over north India was affected by some active western disturbances which in association with their secondaries gave widespread rain in Kashmir, East Punjab and Rajputana with snow over and near the hills, widespread thunderstorm rain in the central parts of the country, the United Provinces, and northeast India and hailstorms at a number of places in north India. A few severe duststorms also occurred in Rajputana, the west United Provinces and in the plains of East Punjab in May.

Almost all the western disturbances which affected India during January, June, October, November and December were feeble and confined their activity to the extreme north of the country.

A list of the disturbances (forty-four in number) classified according to the nature of the precipitation caused by them is given in the following table. The detailed description of the active disturbances of February is also given below.

NO. OF WESTERN DISTURBANCES

Nature of precipitation	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Widespread	1	2	..	2	..	..	..	..	..	..	..	1
Local .	2	1	4	1	4	1	..	..	..	..	..	2
Little or nil	4	3	2	2	..	4	..	1	..	2	3	2
Total .	7	6	6	5	4	5	..	1	..	2	3	5

Western Disturbances during the period 31st January to 7th February.—A western disturbance lay over west Baluchistan on 31st January with its parent disturbance over Russian Turkistan. The secondary moved over to north Baluchistan and adjoining parts of Afghanistan on 1st February. On 2nd February, the disturbance lay over Afghanistan. Widespread rain or snow occurred in Kashmir, East Punjab and in Kumaon hills on the 2nd. On 3rd February, the western disturbances lay over north North West Frontier Province and the adjoining parts of northwest Punjab while a tertiary western disturbance which it induced lay over southeast Rajputana and the adjoining parts of Madhya Bharat. A fresh western disturbance had also moved into Baluchistan. Under the combined influence of these three, widespread rain or snow occurred in Kashmir and East Punjab and widespread thunder-rain in the United Provinces. Mussoorie and Dalhousie experienced heavy falls, recording 4″ and 2″ of rain respectively during the 24 hours ending at 0800 hrs. I.S.T. of 3rd. On 4th morning, the first western disturbance was lying over Kashmir and neighbourhood with its secondary over southeast United Provinces, while the other disturbance had moved over to East Punjab from Baluchistan. Widespread thunder-rain occurred in East Punjab, the United Provinces, west Central Provinces and east Madhya Bharat and local showers in northeast Rajputana. A few stations in northwest United Provinces experienced heavy falls. During the 24 hours ending 0800 hrs. I.S.T. of 4th, Mussoorie and Ambala recorded 3″ of rain each, Meerut 2″ and Ludhiana 1½″. On the 4th evening, the western disturbance over the East Punjab induced a secondary over southeast Rajputana and adjoining parts of the west United Provinces. The two western disturbances moved away eastwards on 5th ; the secondary of the first lay over West Bengal and the secondary of the second over the southwest United Provinces and adjoining parts of Madhya Bharat and of the Central Provinces. The moisture brought in by these disturbances and their secondaries caused general thunder-rain and a few hailstorms in East Punjab and the United Provinces, widespread thunder-rain in east Madhya Bharat, east Central Provinces, north Bihar and sub-Himalayan West Bengal. A number of stations in United Provinces experienced heavy falls. During the 24 hours ending 0800 hrs. I.S.T. of 5th, Dehra Dun recorded 4″ of rain, Roorkee and Banaras 3″ each and Sialkot, Dharampur, Bareilly, Muktesar and Azamgarh 1½″ each. The secondary over West Bengal moved away eastwards across Assam on 6th, after giving local showers in Assam. On the same day the other secondary lay over east United Provinces and adjoining parts of Bihar. It caused widespread thunder-rain in east and north United Provinces, north Bihar and sub-Himalayan West Bengal and fairly widespread rain in east Central Provinces. Dalhousie recorded 3″ and Gonda, Patna, Darbhanga and Ranchi 1½″ of rain each during the 24 hours ending 0800 hrs. I.S.T. of 6th. By the 7th, the secondary over east United Provinces and neighbourhood moved away eastwards across Assam, giving widespread thunder-rain in West Bengal and local rain in east Bihar, Orissa and Assam.

In the rear of these disturbances, there was a surge of cold air from northern latitudes resulting in a cold wave over Saurashtra, Gujarat, the central parts of the country and the northern half of the Peninsula between the 6th and 9th and in northeast India on the 8th and 9th. Night temperatures fell to as low as 10° to 16° F. below normal over the stretch of the country from Saurashtra and Madhya Bharat to the north Deccan and the east Central Provinces on 8th and 9th.

The following weather information relating to the above western disturbances has been gathered from newspapers.

Heavy Snowfall at Simla on 4th and 5th.—Snowfall in Simla continued on 5th with only occasional breaks. The snowfall recorded on 5th morning exceeded one foot.

Kufri and Phagu situated at an altitude of 8,000 ft. registered over two and a half feet of snow. The motor road to Narkanda was blocked. The temperature dropped five degrees below the freezing point.

On 4th February, the city lay under one-foot deep mantle of snow. Rain, sleet and snow followed each other in rapid succession.

The telegraphic and telephonic communications were severely disturbed. Vehicular traffic was also affected. A report of one and a half feet of snow was received from Mashobra.

Heavy Snowfall in Simla Hills on 5th and 6th February.—For the first time since 1944 snow has fallen at Solan, Dharampur on the Simla-Kalka line and at Kasauli;

Six inches of snowfall occurred at Solan, eight inches at Dharampur and ten inches at Kasauli.

Snowstorm and Hailstorm over Mussoorie on 4th.—Roofs were blown off, windows broken and telegraph wires snapped by a snowstorm and hailstorm that swept over Mussoorie on 4th night resulting in damage to telegraph lines and electric mains. Mussoorie had 13″ of snow on this night.

III.—LOCAL STORMS

Of the local storms reported in the newspapers, the following are noteworthy :—

Place	Date	Time	Classification of storm	Loss of human life	Remarks
Dum Dum (West Bengal)	7th March	Evening	Hailstorm	..	Altogether seven planes were damaged at the Dum Dum Airport. Four small planes damaged beyond repair were valued approximately at Rs. 1,40,000. The velocity of the wind at its maximum was about 76 mph.
Sylhet (Assam)	7th March	..	Thunderstorms accompanied by severe squall.	6	The squall was estimated to have reached a velocity of about 60 mph. causing many houses to collapse. About 1,000 structures including several school buildings and railway quarters were blown down causing damage of several lacks of rupees.
Hyderabad (Dn.)	2nd April	Night	Thunderstorm accompanied by squall and heavy rain.	..	Power and telephone systems were dislocated in certain parts of city. A few Katcha houses were damaged.
Calcutta (West Bengal)	9th April	Afternoon	Thunderstorm accompanied by squall.	..	A heavy shower accompanied the storm flooding many low-lying areas and dislocation of traffic. The wind reached over 50 mph. in the centre of the city.
Patna (Bihar)	11th April	Evening	Duststorm followed by a heavy thundershower.	..	The town was plunged into darkness owing to the failure of electricity. In some parts of the city, uprooted trees and telegraph poles blocked roads. Telegraph and telephone services were dislocated. An aerial mast at the A.I.R. transmitting station—254 ft. high also collapsed at a height of about 90 ft.
Calcutta (West Bengal)	11th April	Night	Thunderstorm accompanied by squall.	..	The wind reached a maximum velocity of about 60 mph.
Calcutta (West Bengal)	14th April	Noon	Thunderstorm accompanied by squall and heavy rain.	..	The downpour was very heavy 1·10″ of rain falling within only half an hour. The wind reached a velocity of 54 mph. Many low-lying areas were flooded and the city's tramway service dislocated.
Shillong (Assam)	20th April	Morning	Thunderstorm accompanied by severe squall.	..	Life in city was brought to standstill. Buildings were damaged, telegraph, telephone and electrical lines cut and traffic dislocated. Many old trees were uprooted. Heavy damage was done in rural areas where a large number of houses were blown down.
Sylhet (Assam)	20th April	..	Thunderstorm accompanied by squall.	..	Many huts in the suburbs collapsed and many trees fell. Buro crops got submerged in large areas.
Calcutta (West Bengal)	25th April	Morning	Thunderstorm accompanied by squall and intense and heavy rainfall.	..	The wind reached a maximum speed of 51 mph. Rainfall was heaviest in the central parts of the city—about 1½″ within only half an hour. Many low-lying areas were flooded.
Calcutta (West Bengal)	26th April	Afternoon	Do.	..	The wind reached a maximum speed of 62 mph. Many low-lying areas were flooded in the city. Vehicular traffic remained suspended in these areas for about two hours. In a little over an hour, 1·39″ of rain were recorded.
Muzaffarpur (Bihar)	27th April	Noon	Thunderstorm accompanied by squall and hailstorm	2	The hailstones were reported to be of the size of tennis balls in some places. Trees on road sides and in fruit gardens for several miles were completely uprooted damaging cattle, houses, huts and wells. Roofs were seen being carried away by wind.
Chapra Dt.	27th April	..	Severe hailstorm	60	Several hundreds of cattle were also killed besides 60 persons.
Tarul and Bilaspur (P.S. Khandokosh).	30th April	..	Severe thunderstorm accompanied by heavy rain.	12	Several people were also injured due to the collapse of huts. A large number of cattle was washed away and over 500 persons rendered homeless.
Burdwan (West Bengal)	2nd May	..	Thunderstorm accompanied by squall.	..	Several houses were damaged and road traffic dislocated. It was expected to cost about Rs. 50,000 for the rehabilitation of the homeless people.
Calcutta (West Bengal)	6th May	Afternoon	Severe thunderstorm accompanied by squall.	2	The gale reached a speed of about 72 mph. Tram services on the Alipore section were suspended for over an hour. Several trees were uprooted in the suburbs. In many places roofs of huts were blown away. The planes coming from Chittagong and Dacca could not land at Dum Dum and had to return.
Ratnagiri (Konkan)	8th May	..	Severe thunderstorm	1	Two persons were struck by lightning. One died immediately.
Kumbakonam (South-east Madras)	12th May	Evening	Thunderstorm accompanied by heavy rain.	..	Telephone lines were cut and electric supply also failed. Many buildings collapsed.
Pathankot Jammu area (Kashmir)	27th May	Afternoon	Severe duststorm	..	Communications were paralysed for a few hours.
Banaras (U.P.)	28th May	Night	Thunderstorm accompanied by squall.	..	Hundreds of trees were uprooted and many roofs blown off. Roads were blocked and there was a breakdown in the electric supply. All trunk telephone lines were paralysed throughout the night.
New Delhi. (East Punjab).	26th May	Evening	Duststorm followed by thunderstorm and hailstorm.	..	Some 125 local telephone lines were put out of order, the wires being ripped or short circuited by falling branches of trees. In refugee camps, several tents were blown away.

IV.—WINDS OF FORCE NINE OR MORE IN THE INDIAN SEAS

Excluding dates of storms and depressions, a description of which has been given above, winds of force 9 or more were recorded on ships in the Indian Seas during the year 1949 on the following occasions :—

Date	Name of ship	Approximate position		Date	Name of ship	Approximate position	
		Lat. °N.	Long. °E			Lat. °N.	Long. °E.
1-2-1949	S. S. British Energy	25·0	58·1	2-6-1949	S. S. Nizam	15·2	83·2
11-2-1949	S. S. Glasgow	20·5	59·7	2-6-1949	S. S. Nizam	13·9	83·2
9-3-1949	S. S. Georgie	0·8	66·2	10-8-1949	S. S. Jalaveera	13·9	91·5
11-4-1949	S. S. Karanjia	14·3	60·7	14-8-1949	S. S. Maharaja	18·5	89·8
28-5-1949	S. S. Maskoma	16·5	70·5	25-10-1949	S. S. Mahout	8·1	72·6
29-5-1949	S. S. Makamponi	17·3	66·7				

PUBLICATIONS OF THE INDIA METEOROLOGICAL DEPARTMENT

(Complete list, upto October 1953, including those Publications which are now out of print.)

Notes:—

1. ALL THE PRICED PUBLICATIONS EXCEPTING THE DAILY, WEEKLY AND MONTHLY WEATHER REPORTS, AND THOSE ITEMS WHICH ARE 'OUT OF PRINT', ARE AVAILABLE FOR SALE WITH THE MANAGER OF PUBLICATIONS, CIVIL LINES, DELHI-8.
2. INDIAN DAILY WEATHER REPORT, WEEKLY WEATHER REPORT, AND MONTHLY WEATHER REPORT ARE AVAILABLE FOR SALE IN THE OFFICE OF THE DEPUTY DIRECTOR GENERAL OF OBSERVATORIES (FORECASTING) METEOROLOGICAL OFFICE, POONA-5.
3. DAILY REGIONAL WEATHER REPORTS FOR CALCUTTA, NEW DELHI, NAGPUR, BOMBAY AND MADRAS ARE AVAILABLE FOR SALE AT THE RESPECTIVE REGIONAL METEOROLOGICAL CENTRES.

I. GENERAL.—

Instructions to observers at the 2nd and 3rd class observatories, edition 3 (1943). Rs. 1-10 or 2*s.* 6*d.* *(Revised edition in press).	Departmental.
Cloud Atlas, edition 3 (1945). Rs. 2-2 or 3*s.* 6*d.**	Ditto.
Tables for the Reduction of Meteorological Observations in India, Reprint of 3rd edition (1947). Rs. 5-12.	Ditto.
Relative Humidity Tables (1937). As. 7 or 9*d.**	Ditto.
Hygrometric Tables (1000 mb.) edition 2 (1949). As. 14 or 1*s.* 3*d.*	Ditto.
Hygrometric Tables (900 mb.) edition 2 (1948). Rs. 1-14 or 2*s.* 9*d.*	Ditto
Hygrometric Tables (800 mb.) edition 2 (1949). Rs. 2-12 or 4*s.* 6*d.*	Ditto
Hygrometric Tables (700 mb.). 1944.	Ditto.
Hygrometric Tables, Vapour Pressure. Rs. 3-8 or 5*s.* 6*d.*	Ditto.
Saturation Temperature Tables (1942). As. 10.	K. N. Rao.
Rainfall Organisation (1929). As. 2.	Departmental.
Service Instructions for Part-time Observers (1952).	Ditto.
Instructions for making entries in Pocket Register and Monthly Meteorological Register (in press).	Ditto.
Weather Code (1949). As. 12 or 1*s.** (New edition in press).	Ditto.
Brief Weather Code (1949). Rs. 1-6 or 2*s.*	Ditto.
Aviation Weather Codes (1949). As. 8 or 9*d.*	Ditto.
Codes for reporting upper Winds and Cloud Directions (1949). As. 7 or 8*d.*	Ditto.
Code for Upper Air Reports (1949). As. 9 or 10*d.*	Ditto.
Ships' Weather Code (1949). Rs. 1-10 or 2*s.* 6*d.*	Ditto.
Reports on the Meteorology of India for the years 1875—1890 (16 volumes). Each Rs. 10.†	Ditto.
Meteorology of the Bombay Presidency (1878).	C. Chambers.
Weather and the Indian Farmer (1946).	Departmental.
Meteorology in India.	Ditto.
Kodaikanal Observatory (1901—1951). Re. 1.	Ditto.
Meteorology of Persian Gulf and Mekran Coast (1931). Rs. 3 or 5*s.* 6*d.*	B. N. Banerji.

II. AVIATION METEOROLOGY.—

Meteorology for Airmen in India—	
Part I—General Meteorological features. Edition 2 (1949). Rs. 4-10 or 7*s.* 3*d.*	Departmental
Part II—Climatology of Air Routes (1936).* Rs. 2-2 or 4*s.* 10*d.*	Ditto.
India's Climates—Summary for Airmen (1943). Re. 1 or 1*s.* 6*d.*	Ditto.
Meteorological Organisation for Airmen, M.O.A. pamphlet (1949).	Ditto.
Meteorological Conditions affecting aviation over the Northwest Frontier (1934). Rs. 1-8 or 2*s.* 6*d.*	R. G. Veryard and A. K. Roy.

III. ATLASES AND CHARTS.—

Climatological Atlas of India (1906).* Rs. 27.	Sir John Eliot.
Meteorological Atlas of the Indian seas and the North Indian Ocean (1908).* Rs. 13.	W. L. Dallas.
Monthly Weather Charts of the Bay of Bengal and adjacent sea north of the equator, showing mean pressure, winds and currents (1886).* Rs. 5.	H. F. Blanford.
Monthly Weather Charts of the Arabian Sea and the adjacent portion of the North Indian Ocean showing mean pressure, winds and currents (1888). Rs. 5.	Sir John Eliot.
Charts of Bay of Bengal and adjacent sea north of equator showing specific gravity, temperature and currents of the sea surface (1887). Rs. 1-8.	W. L. Dallas.
Daily Weather Reports and Charts of the Indian Monsoon Area for the Years 1893 to 1899, each month. Re. 1*.	Departmental.
Normal Weather and Pilot Charts of the Indian Monsoon Area for 8 a.m. for each month November 1900 to August 1908, each month. As. 4.*	Ditto.
Storm Tracks in the Bay of Bengal (1925). Rs. 3-6 or 5*s.* 9*d.**	C. W. B. Normand.
Storm Tracks in the Arabian Sea (1926). Rs. 3-8 or 6*s.**	Ditto.
Climatic Charts of India and Neighbourhood for Meteorologists and Airmen (1943).*	Departmental.
Climatological Atlas for Airmen (1943). Rs. 5-2 or 8*s.*	Ditto.
Climatological Charts of the Indian Monsoon Area (1945). Rs. 16 or 25*s.*	Ditto.

IV. CYCLONE MEMOIRS, ETC.—

Handbook of Cyclonic storms in the Bay of Bengal for use of Sailors—	
Vol. I—Text. 2nd edition (1900). Rs. 4.*	Sir John Eliot.
Vol. II—Plates. 2nd edition (1901). Rs. 1-8.*	Ditto.
Handbook of Cyclonic storms in the Bay of Bengal (Abridged) 1943. Re. 1.	Departmental.

Cyclone Memoirs—

Part I—Bay of Bengal Cyclone of May 20th to 28th, 1887 (1888). Re. 1.*	Ditto.
Part II—Bay of Bengal Cyclone of August 21st to 28th, 1888 (1890). Rs. 3.	Ditto.

* Out of print.

† Copies for the years 1875 , 1876, 1878 to 1881, 1884, 1887, and 1890 are out of print.

CYCLONE MEMOIRS, ETC.—(contd.)

Cyclone Memoirs—(contd.)

Part III—Bay of Bengal Cyclones of September 13th to 20th and October 27th to 31st, 1888, and Arabian Sea Cyclone of November 6th to 9th, 1888 (1890). Rs. 5.	Departmental.
Part IV—An enquiry into the nature and course of storms in the Arabian Sea and a catalogue and a brief history of all recorded storms in the Arabian Sea from 1848—1889 (1891). Rs. 3.	W. L. Dallas.
Part V—Account of three cyclones in the Bay of Bengal and Arabian Sea during November 1891 (1893). Rs. 3.*	Sir John Eliot.
Report of the Midnapore and Burdwan Cyclone of the 15th and 16th of October 1874 (1875). Rs. 3.*	W. G. Wilson.
Report of the Vizagapatam and Backergunge Cyclones of October 1876 (1877). Rs. 3.*	Sir John Eliot.
Report on the Madras Cyclone of May, 1877 (1879). Rs. 3.*	Ditto.
Winds, Weather and Currents on the coasts of India and the laws of storms, edition 2 (1942). Rs 2-2 or 3*s.* 6*d.*	Departmental.

V. CLIMATOLOGICAL TABLES, ETC.—

Five-day Normals of Maximum and Minimum Temperatures and Accumulated Rainfall (1931). Rs. 4 or 6*s.* 6*d.*	Ditto.
Five-day Normals of Pressure at 9 hrs. I. S. T. (1943). Rs. 2-2 or 3*s.* 6*d.*	Ditto.
Five-day Normals of Pressure at 18 hrs. I. S. T. (1943). Rs. 1-12 or 2*s.* 6*d.*	Ditto.
Five-day Normals of Relative Humidity at 9 hrs. I. S .T. (1944). Rs. 2-8 or 4*s.*	Ditto.
Five-day Normals of Relative Humidity at 18 hrs. I.S.T. (1943). Rs. 2-2 or 3*s.* 6*d.*	Ditto.
Climatological Tables of Observatories in India (in press).	Ditto.
Aviation Climatological Tables (1944). Rs. 8-8 or 13*s.* 6*d.*	Ditto.

VI. SCIENTIFIC NOTES.—

Vol. I—

No. 1.	Comparison of upper gradient winds, Agra and Bangalore. Rs. 1-3 or 2*s.**	Mohamad Ishaque.
No. 2.	An analysis of the Madras hourly rainfall records for the years 1865 to 1875 and 1901 to 1917. As. 9 or 1*s.*	V. Doraiswamy Iyer.
No. 3.	Thunderstorms of Calcutta, 1900—1926. As. 14 or 1*s.* 3*d.**	V. V. Sohoni.
No. 4.	On temperatures of exposed rails at Agra. As. 8 or 10*d.*	K.R.Ramanathan.
No. 5.	Frequency of thunderstorms in India. As. 6 or 8*d.**	Departmental.
No. 6.	Correlation between pre-monsoon conditions over N. W. India and subsequent monsoon rainfall over N. W. India and the Peninsula. As. 6 or 9*d.*	M. V. Unakar.
No. 7.	Normal monthly upper winds over eight stations in India. Rs. 1-12 or 3*s.**	Departmental.
No. 8.	Monthly normal isobars and wind-roses at 0·5, 1, 2 and 3 Kms. above sea level over India and neighbourhood. Rs. 4 or 6*s.* 9*d.**	Ditto.
No. 9.	Comparison of temperatures in Stevenson screens at heights of 6 ft., 4 ft. and 2 ft. As. 7 or 9*d.**	K. R. Ramanathan.
No. 10.	Distribution of temperature in the lower stratosphere. Re. 1 or 1*s.* 9*d.**	P. R. Krishna Rao.

Vol. II—

No. 11.	Comparative observations of temperature inside white painted, unpainted and black painted Stevenson screens. As 6. or 8*d.**	Barkat Ali.
No. 12.	The association of the mid-monsoon Indian rainfall with pressure distribution over the globe. As. 10 or 1*s.*	M. V. Unakar.
No. 13.	Atmospheric instability at Agra associated with a western disturbance. As. 14 or 1*s.* 6*d.**	K. R. Ramanathan.
No. 14.	Horizontal atmospheric visibility at Agra. As. 6 or 8*d.**	Barkat Ali.
No. 15.	Winds in higher levels over Agra. Re. 1 or 1*s.* 9*d.**	N. K. Sur.
No. 16.	Winds in the first 3 km. over Port Blair. As 12 or 1*s.* 3*d.**	K. P. Ramakrishnan.
No. 17.	Tables of monthly average frequencies of surface and upper winds up to 3 Kms. in India Parts A—D Rs. 4-8 or 8*s.* 6*d.*	Departmental.

Vol III—

No. 18.	The structure of the Madras storm of January, 1929 Rs. 1-10 or 2*s.* 6*d.**	K. R. Ramanathan and A.A. Narayan Aiyar.
No. 19.	Distribution of air density at mean sea level over India. Rs. 1-4 or 2*s.**	U. N. Ghose.
No. 20.	Correlation between rainfall in N. W. India and height of Indus river at Sukkur. As. 6 or 8*d.*	M. V. Unakar.
No. 21.	Upper air circulation over India and its neighbourhood up to the Cirrus level during the winter and the monsoon. Rs. 2 or 3*s.* 6*d.**	H. C. Banerjee and K. R. Ramanathan.
No. 22.	The structure and movement of a storm in the Bay of Bengal during the period 13th to 19th November 1928. Rs. 2-4 or 4*s.* 3*d.**	K. R. Ramanathan.
No. 23.	A historical note on the catch of raingauges. Re. 1 or 1*s.* 9*d.**	H. R. Puri.
No. 24.	On the utility of observations of barometric characteristics and tendencies for local forecasting in North-West India. As. 8 or 10*d.**	R. P. Batty.
No. 25.	Heights of base of clouds in India as determined from pilot balloon ascents. As. 5 or 6*d.**	M. V. Narayanan and M. P. Manna.
No. 26.	Some statistical relations of temperature and pressure in the upper atmosphere over Agra and Batavia. As. 4 or 5*d.**	S. Gopal Rao.
No. 27.	A study of thunderstorms in Poona in 1930. Re. 1-2 or 2*s.**	B. N. Desai.
No. 28.	Horizontal gradients of pressure and temperature in the upper atmosphere over India. As. 6 or 8*d.**	A. Narayanan.
No. 29.	The Bengal Cyclone of September 1919. Re. 1-4 or 2*s.**	V. Doraiswamy Iyer.
No. 30.	The structure of the sea breeze at Poona. Re. 1 or 1*s.* 9*d.**	K. R. Ramanathan.

Vol. IV—

No. 31.	The lunar atmospheric tide at Kodaikanal and Peryiakulam. As. 4 or 5*d.**.	S. K. Pramanik, S.C. Chatterjee and P. P. Joshi.
No. 32.	On the relation between the weather and the variation of the normal vertical gradients of temperature in North-West India. As. 9 or 1*s.**	S. Atmanathan.
No. 33.	Temperature changes in Calcutta thunderstorms. As. 10 or 1*s.**	V. V. Sohoni.
No. 34.	A study of two pre-monsoon storms in the Bay of Bengal and a comparison of their structure with that of the Bay storms in the winter months. Re. 1- 4 or 2*s.**	K. R. Ramanathan, and H.C. Banerjee.
No. 35.	An improved method of sounding the lower layers of the atmosphere. As. 6 or 8*d.**	G. Chatterjee.
No. 36.	Contrivances for lifting the pens off the recording plate of the Dines' balloon meteorograph during its descent. As. 5 or 6*d.**	G. Chatterjee and P. M. Neogi.
No. 37.	The seasonal forecasting formulae used in the India Meteorological Department. As. 7 or 9*d.**	S. R. Savur.
No. 38.	Rainfall of Siam. Re. 1 or 1*s.* 9*d.**	V. Doraiswamy Iyer.
No. 39.	A study of the structure of the Bay storm of November 1926. Rs. 2-2 or 4*s.**	Sobhag Mal and B. N. Desai.
No. 40.	The katabatic winds of Poona. Re. 1 or 1*s.* 9*d.**	S. Atmanathan.

* Out of print.

SCIENTIFIC NOTES.—(contd.)

Vol. IV—(contd.)

No. 41.	The sea breeze at Karachi. Rs. 1-8 or 2*s.* 6*d.**	L. A. Ramdas.
No. 42.	A discussion of monthly mean values of upper air temperatures and humidities obtained from aeroplane ascents at Peshawar and Quetta. As. 10 or 1*s.**	A. Narayanan.
No. 43.	On the extreme dryness observed at Kodaikanal during the winter months. Rs. 1-8 or 2*s.* 6*d.**	S. L. Malurkar.
No. 44.	Thunderstorm in the Peninsula during the pre-monsoon months April and May. Rs. 1-10 or 2*s.* 9*d.**	S.P. Venkiteshwaran.
No. 45.	The method of coincidences or a quick method of determining the approximate value of a simple correlation coefficient. As. 3 or 4*d.**	S. R. Savur.

Vol. V—

No. 46.	On solitary gusts associated with reversals of pressure gradients. As. 10 or 1*s.**	S. Atmanathan.
No. 47.	Horizontal atmospheric visibility at Quetta. As. 8 or 10*d.**	A.K. Roy.
No. 48.	On some characteristics of the tropopause and upper troposphere over N. W. India. Rs. 1-2 or 2*s.**	N. K. Sur and J. C. Roy.
No. 49.	Tables extending Walker's criteria and for finding the chance of success of a forecast. As. 6 or 8*d.**	S. R. Savur and S. Gopal Rao.
No. 50.	Inversions of lapse-rate over Karachi. As. 6 or 8*d.**	A. S. Hariharan.
No. 51.	A preliminary study of the rainfall at Quetta. As. 10 or 1*s.**	A. K. Roy and R. C. Bhattacharya.
No. 52.	Thunderstorms in South India during the post-monsoon months, October and November 1929. Re. 1 or 1*s.* 9*d.**	S. P. Venkiteshwaran.
No. 53.	A note on the rapid fluctuations of atmospheric pressure and the atmospheric instability at Peshawar during 1928 and 1929. As. 12 or 1*s.* 3*d.**	S. Basu and S. K. Pramanik.
No. 54.	A note on fog and haze at Poona during the cold season. Rs. 1-2 or 2*s.**	L. A. Ramdas and S. Atmanathan.
No. 55.	On the nature of the frequency distribution of precipitation in India during the monsoon months, June to September. As. 10 or 1*s.**	D. Sankaranarayanan.
No. 56.	A preliminary study of a tornado at Peshawar. Rs. 2 or 3*s.* 6*d.**	R. G. Veryard.
No. 57.	Humidity records obtained at Agra with hair elements and with wet and dry elements in a Dines' meteorograph. As. 7 or 9*d.**	S. P. Venkiteshwaran.
No. 58.	On forecasting weather over northeast Baluchistan during the monsoon months July and August. As. 4 or 5*d.**	A. K. Roy and R. C. Bhattacharya.
No. 59.	A Statistical study of the maximum temperatures at Poona. As. 6 or 8*d.**	R. J. Kalamkar.
No. 60.	A Study of horizontal atmospheric visibility at Bangalore. As. 10 or 1*s.**	A. Anantapadmanabha Rao.

Vol. VI—

No. 61.	Evaporation in India calculated from other meteorological factors. (Reprint). Rs. 3-8 or 5*s.* 6*d.*	P. K. Raman and V. Satakopan.
No. 62.	The distribution of temperature in the upper levels of a depression originating in the Bay of Bengal during the Indian southwest monsoon. As. 5 or 6*d.**	N. K. Sur.
No. 63.	Wind data for wind mills. 2nd and revised edition (1949). Rs. 2 or 3*s.*	Departmental.
No. 64.	Some observations on the thermal structure of cumuliform cloud. Re. 1-4 or 1*s.* 6*d.**	R. G. Veryard.
No. 65.	The thermal structure of the upper air over a depression during the Indian southwest monsoon. As. 8 or 10*d.**	N. K. Sur.
No. 66.	Normal monthly percentage frequencies of upper winds at 4, 6, 8 and 10 Kms. above sea level obtained from pilot balloon ascents. Rs. 3-12 or 6*s.* 6*d.**	Departmental.
No. 67.	Measurement of vertical currents in the atmosphere, mainly of thermal origin, with pilot balloons. As. 14 or 1*s.* 6*d.**	K. R. Ramanathan. and K. P. Ramakrishnan.
No. 68.	Hourly rainfall at Lahore. As. 8 or 10*d.**	V. Doraiswamy Iyer and V. Lakshmi-Narasimhan.

Vol. VII—

No. 69.	A statistical analysis of the distribution of the southwest monsoon rainfall at Akola. As. 12 or 1*s.* 3*d.**	V. Satakopan.
No. 70.	A study of correlation coefficients of mean maximum temperatures between successive months at a few selected stations in India. As. 5 or 6*d.**	R. J. Kalamkar.
No. 71.	A note on the statistical study of rainfall in the Mysore State. As. 7 or 9*d.**	A. Anantapadmanabha Rao.
No. 72.	Normal monthly percentage frequencies of surface and upper winds up to 3 kms. at Allahabad, Begumpet, Delhi, Sambalpur, Sandoway, Silchar and Victoria Point. As. 12 or 1*s.* 3*d.**	Departmental.
No. 73.	Daily variations of temperature and pressure at different levels over Agra associated with passage of western disturbances. As. 12 or 1*s.* 3*d.**	S. P. Venkiteshwaran.
No. 74.	The rainfall in the Indian Peninsula associated with cyclonic storms from the Bay of Bengal during the post monsoon and early winter seasons. Rs. 1-10 or 2*s.* 2*d.**	K. P. Ramakrishnan.
No. 75.	Squalls at Karachi. Rs. 1-14 or 3*s.* 3*d.**	P. R. Krishna Rao.
No. 76.	Average intensity of rainfall on a rainy day in India. As. 12 or 1*s.* 3*d.**	V. Doraiswamy Iyer and Kasturinath Sobti.
No. 77.	Distribution of heavy rainfall over India. As. 12 or 1*s.* 3*d.**	V. Doraiswamy Iyer and Mohammad Zafar.
No. 78.	Temperatures and humidities up to 3 kms. over Karachi. As. 9 or 10*d.**	P. R. Krishna Rao and K. L. Bhatia.
No. 79.	Atmospheric electric potential gradient, conductivity and air-earth current on electrically 'quiet' days at Colaba. Rs. 1-4 or 2*s.**	S. M. Mukherjee.
No. 80.	Normal monthly percentage frequencies of surface and upper winds (afternoon) up to 3 kms. in India, Burma and Persian Gulf. Rs. 3-6 or 5*s.* 6*d.*	Departmental.
No. 81.	Vertical currents in the first few kilometres over Poona and their possible effect on the measures of upper winds made by pilot balloons assumed to rise at a known constant rate. As. 9 or 10*d.**	K. P. Ramkrishnan.
No. 82.	An analysis of Indian rainfalls using the median as a statistic. As. 12 or 1*s.*	L. S. Mahalingam.

Vol. VIII—

No. 83.	On the forecasting of rain over south Bengal during the season, mid-March to mid-May. As. 5 or 6*d.**	A. K. Roy.
No. 84.	A Statistical analysis of the monthly rainfalls in the Amraoti district (Berar). As. 5 or 6*d.*	N. Rajagopalan.
No. 85.	A note on some measurements of cloud heights at Poona, Bombay and Madras. As. 8 or 9*d.**	K. P. Ramakrishnan.
No. 86.	Determination of visibility at night with the help of Wigand's or Bennett's visibility meter. As. 5 or 6*d.*	A. K. Roy.
No. 87.	A discussion of some aeroplane ascents at Drigh Road (Karachi) on days of dust-storms, thunderstorms and dust raising winds. As. 8 or 9*d.*	B. N. Desai and S. Mal.

* Out of print.

SCIENTIFIC NOTES.—(contd.)

Vol. VIII—(contd.)

No. 88.	A historical note on the standard for the measurement of atmospheric pressure in India. As. 10 or 1*s*.	J. M. Sil.
No. 89.	Synoptic and aerological study of a thunderstorm day at Agra, December, 3rd, 1936. Re. 1 or 1*s*. 6*d*.	S. Basu and Ram Sahay.
No. 90.	Averages of temperatures and humidities in the upper air over Agra in the Polar year 1932-33. As. 12 or 1*s*.	S. Basu, Ram Sahay and K. J. Kabraji.
No. 91.	The Hindukush earthquake of November 21st, 1939. As. 8 or 9*d*.	S. M. Mukherjee and A. R. Pillai.
No. 92.	Correlation between frost and the preceding meteorological conditions. Part II (Jaipur). As. 5 or 6*d*.	B. Ali and S. N. Naqvi.
No. 93.	Heat radiation from the atmosphere at Bombay and its comparison with that at Poona. As. 9 or 10*d*.	R. Narayanswami.
No. 94.	Photographic studies of some cloud forms and their changes with time. Rs. 1-8 or 2*s*. 3*d*.	M. W. Chiplonkar.
No. 95.	Forecasting monsoon rainfall in Mysore. As. 10 or 1*s*.	V. Doraiswamy Iyer and C. Seshachar.
No. 96.	Frequency of thundery conditions at Bombay compared with those at some other stations in India. As. 8 or 9*d*.	M. W. Chiplonkar.
No. 97.	The sea breeze at Madras. As. 12 or 1*s*.	A. K. Roy.
No. 98.	Forecasting the N. E. monsoon rainfall of south Madras. As. 6 or 7*d*.	V. Doraiswamy Iyer.
No. 99.	Diurnal variation of rainfall at Colaba (Bombay) from an analysis of hourly rainfall records. As. 10 or 1*s*.	Ditto.
No. 100.	Dust devil at Karachi on 28th February, 1941. As. 14 or 1*s*. 6*d*.	P. R. K. Rao and S. N. Sen.

Vol. IX—

No. 101.	Regression formulae for forecasting the monsoon rainfall in the sub-divisions of Peninsular India. As. 12 or 1*s*.	V. Doraiswamy Iyer and V. Satakopan.
No. 102.	A discussion of hourly rainfall and associated wind direction at Bangalore. As. 5 or 6*d*.	C. Seshachar.
No. 103.	Sunshine at Rangoon. As. 5 or 6*d*.	S. S. Lal.
No. 104.	Diurnal variation of rainfall at Simla. As. 5 or 6*d*.	V. Doraiswamy Iyer and Mohammad Zafar.
No. 105.	Diurnal variation of rainfall at Mahabaleshwar. As. 6 or 7*d*.	V. Doraiswamy Iyer and Ishwar Dass.
No. 106.	Lapse rates of temperature in the lower layers of the atmosphere determined with the aid of temperature indicators. Rs. 1-10, or 2*s*. 6*d*.	B. N. Sreenivasaiah.
No. 107.	Post-Monsoon heat waves at Karachi. As. 3 or 4*d*.	V. Ganesan.
No. 108.	Land breeze at Calcutta (Alipore). As. 10 or 1*s*.	P. K. Sen Gupta and K. C. Chakravortty.
No. 109.	Inter-diurnal variations of pressure and temperature in the upper atmosphere over North India. As. 14 or 1*s*. 3*d*.	M. W. Chiplonkar.
No. 110.	An analysis of the hourly rainfall records at Poona. As. 14 or 1*s*. 3*d*.	V. L. Narasimhan and Md. Zafar.
No. 111	Some noteworthy features shown by soundings made in the field of a depression originating in the north Bay of Bengal during the southwest monsoon season in India. As. 14 or 1*s*. 3*d*.	N. K. Sur and S. Yegnanarayanan.
No. 112.	The chronometric Radiosonde of the India Meteorological Department. Rs. 1-12 or 2*s*. 6*d*.	L. S. Mathur.
No. 113.	The Fan-type Radio meteorograph of the India Meteorological Department. Rs. 1-10 or 2*s*. 6*d*.	S. P. Venkiteshwaran, R. P. Thatte and A. Keshawamurthy.
No. 114.	A low pressure portable hydrogen generator for Pilot Balloon Observatories. As. 5 or 6*d*.	L. S. Mathur.

Vol. X—

No. 115.	Diurnal variation of visibility of objects at different altitudes and in different directions during the cold season at Poona and its neighbourhood. As. 12 or 1*s*.	C. S. Karve.
No. 116.	A comparison of Cherat surface observations of temperature and humidity at 0800 Hrs. L. T. with aeroplane observations over the Peshawar plain at the same level. As. 6 or 7*d*.	K. L. Bhatia.
No. 117.	Inversion and isothermal layers in the free atmosphere over south India. As. 14 or 1*s*. 3*d*.	A. K. Roy and L. S. Mahalingam.
No. 118.	On microseisms recorded in India and Ceylon. Re. 1-4 or 2*s*.	S. M. Mukherjee.
No. 119.	The sea breeze and diurnal variation of winds at Karachi. As. 9 or 10*d*.	S. N. Ray Choudhuri.
No. 120.	Microseisms and disturbed weather. Rs. 1-8 or 2*s*. 3*d*.	S. K. Pramanik, P.K. Sen Gupta and K. C. Chakravortty.
No. 121.	The correlation of normal climatic elements in India with Latitude, Longitude and Elevation. Part I–Mean daily temperature. Rs. 2-2 or 3*s*. 6*d*.	P. Jagannathan.
No. 122.	The correlation of normal climatic elements in India with Latitude, Longitude and Elevation. Part II—Mean daily range of temperature. Re. 1-2 or 1*s*. 9*d*.	Ditto.
No. 123.	Low stratus clouds over Bangalore. Rs. 2-8 or 4*s*.	P. A. George.
No. 124.	Fog at Calcutta. As. 9 or 10*d*.	K.C. Chakravortty.
No. 125.	The Mekran earthquake of the 28th November 1945. As. 10 or 1*s*.	C. G. Pendse.
No. 126.	Frequency of micropulsations and their variation at Bombay. Re. 1 or 1*s*. 6*d*.	S. K. Chakrabarty.
No. 127.	Computation of winds in the atmosphere in low latitudes—Part I—Stationary Pressure System. As. 6 or 7*d*.	S. K. Pramanik.
No. 128.	Computation of winds in the atmosphere in low latitudes—Part II—Moving Pressure System. Re. 1 or 1*s*. 6*d*.	S. K. Pramanik and S. Mazumdar.
No. 129.	Earthquakes in India and neighbourhood. Rs. 1-14 or 2*s*. 9*d*.	C. G. Pendse.
No. 130.	Aviation weather risks at Delhi. Re. 1 or 1*s*. 6*d*.	K. C. Chakravortty.

Vol. XI—

No. 131.	The Normal monthly contours corresponding to the 850 mb. and 700 mb. isobaric surfaces over India. Rs. 5 or 8*s*.	P. S. Hariharan.
No. 132.	A study of the distribution of rainfall in the Peninsula associated with some pre-monsoon storms. Rs. 3-14 or 6*s*. 3*d*.	P. N. Boothalingam and V. Srinivasan.
No. 133.	A portable ground equipment for the F-Type radiosonde. Re. 1 or 1*s*. 6*d*.	S. P. Venkiteshwaran and others.
No. 134.	Calibration equipment for F-type radio meteorographs. Rs. 3-2 or 5*s*.	S. P. Venkiteshwaran.
No. 135.	Discussion on a method of predicting night minimum temperature in winter. Re. 1-2 or 1*s*. 9*d*. (This series ends with Vol. XI. No. 135.)	K. C. Chakravortty.

VII. TECHNICAL NOTES.—

No. 1.	Notes on forecasting weather in India (1943).	S. L. Malurkar and B. N. Desai.
No. 2.	Ice accretion in India (1943).*	Departmental.
No. 3.	The climate of air layers near the ground at Poona, Part, I (1943).*	L. A. Ramdas.

* Out of print.

TECHNICAL NOTES.—(contd.)

No. 4.	Pibals in daily forecasting (1943).*	C. W. B. Normand.
No. 5.	Height of base and thickness of low clouds in the north of the Bay of Bengal and neighbouring land regions (1943).*	Departmental.
No. 6.	Distance tables for pilot balloon computation. Reprint (1950). Rs. 5-6 or 8*s.* 6*d.*	Ditto.
No. 7.	Forecasting in the equatorial zone.	A. Grimes.
No. 8.	Reporting convection cells (1944).	C. W. B. Normand.
No. 9.	The climate of air layers near the ground at Poona, Part II (1944).	L. A. Ramdas.
No. 10.	Norwesters of Bengal.	Departmental.
No. 11.	Wet bulb temperatures in India.	V. Doraiswamy Iyer.
No. 12.	Fog, mist and haze at Bangalore. As. 6 or 7*d.*	B. N. Sreenivasaiah.
No. 13.	Thermodynamic diagrams and some of their uses. Rs. 1-10 or 2*s.* 7*d.*	P. R. Pisharoty.
No. 14.	Heights of base and thickness of low clouds in the north of the Bay of Bengal and neighbouring land regions. As. 8 or 9*d.*	S. P. Venkiteshwaran.
No. 15.	Diurnal variation of pressure.	Departmental.
No. 16.	Air masses in India. Rs. 3-8 or 5*s.* 6*d.*	A. K. Roy.
No. 17.	Low cloud over Coimbatore during January, February and March. As. 4 or 5*d.*	L. Elsworth
No. 18.	Frequency distribution of lightning around Colaba, Bombay. As. 4 or 5*d.*	R. N. V. R. M. W. Chiplonkar.
No. 19.	Forecasting of surface winds. As. 2 or 3*d.*	S. L. Malurkar.
No. 20.	Quasi-stationary low pressure areas in and near India. As. 2 or 3*d.*	Ditto.
No. 21.	The climate of the air layers near the ground at Poona. Part III. As. 8 or 9*d.*	L. A. Ramdas.
No. 22.	On the utility of observations of barometric tendency for forecasting in India. As. 6 or 7*d.*	A. K. Roy.
No. 23.	Some features of Madras weather. As. 3 or 4*d.*	B. N. Sreenivasaiah.
No. 24.	Heights of base and thickness of clouds in the Bay of Bengal. As. 8 or 9*d.*	George Alexander.
No. 25.	Origin and structure of winter depressions of north west India. Rs. 3-2 or 5*s.*	S. Mull and B. N. Desai.
No. 26.	On the construction, properties and uses of the tephigram. Rs. 2-14 or 4*s.* 9*d.*	R. Ananthakrishnan and S. Yegnanarayanan.
No. 27.	Climatology of Trichinopoly Airfield. Rs. 3 or 4*s.* 6*d.*	P. Jagannat han.
No. 28.	An elementary note on Indian climate. Rs. 1-14 or 2*s.* 9*d.* (This series ends with Technical Note No. 28.)	F/Lt. T. A. S. Balakrishnan.

VIII. INDIAN METEOROLOGICAL MEMOIRS.—

Vol. I—

Part I.	On the winds of Calcutta—An analysis of 10 years' hourly observations of the windvane and four years' anemograms.	H. F. Blanford.
	The meteorology and climate of Yarkand and Kashgar being chiefly a discussion of registers kept by Dr. J. Scully in 1874-75.	Ditto.
	The diurnal variation of the barometer at Simla. Rs. 3.*	Ditto.
Part II.	Storms in Bengal during the year 1876 accompanied with increased atmospheric pressure and the apparent reversal of the normal diurnal oscillation of the barometer.	Sir John Eliot.
	On the rainfall of Banaras considered in relation to the prevailing winds.	S. A. Hill.
	On the diurnal variation of the barometer at Indian stations (Part I): Calcutta and Hazaribagh. Rs. 3.*	H. F. Blanford.
Part III.	Variations of rainfall in Northern India.	S. A. Hill.
	Meteorological and hypsometrical observations in western Tibet, recorded by Dr. J. Scully, with a discussion. Rs. 3.*	H. F. Blanford.
Part IV.	The winds of Karachi. Rs. 3.*	F. Chambers.
Part V.	Some results of the meteorological observations taken at Allahabad during the ten years 1870—79.	S. A. Hill.
	The diurnal variation of the barometer at Indian stations (Part II) : Goalpara, Patna and Leh. Rs. 3.*	H. F. Blanford.
Part VI.	The meteorology of the North-West Himalayas. Re. 1.*	S. A. Hill.

Vol. II—

Part I.	Account of the southwest monsoon storm of the 18th to the 24th of September 1878, in the north of the Bay of Bengal.	Sir John Eliot.
	List of cyclones on the west coast of India and in the Arabian Sea up to the end of year 1881. Rs. 2.*	F. Chambers.
Part II.	Note on the foregoing list of cyclones and on the Gujarat land cyclone of July 11th to 13th, 1881.	H. F. Blanford.
	On the temperature of North-Western India. Rs. 2.*	S. A. Hill.
Part III.	Account of the southwest monsoon storms of the 8th to the 19th October 1882, in the Bay f Bengal. Rs. 2.*	Sir John Eliot.
Part IV.	Account of the southwest monsoon storms generated in the Bay of Bengal during the years 1877 to 1881. Rs. 2.*	Ditto.
Part V	Observations of temperature and humidity at a height of 40 feet above the ground at Alipore Observatory, Calcutta. Re. 1.*	S. A. Hill.

Vol. III—

Rainfall of India (a full discussion of the rainfall of India and cognate subjects. Normal or average rainfall; anomalous variations of the rainfall; two appendices). Rs. 8.*	H. F. Blanford.

Vol. IV—

Part I.	Account of the south-west monsoon storm of the 12th to the 17th of May, 1884, in the Bay of Bengal and at Akyab.	Sir John Eliot.
	On the diurnal variation of the rainfall at Calcutta.	H. F. Blanford.
	The meteorological features of the southern part of the Bay of Bengal. Rs. 3.*	W. L. Dallas.
Part II.	The False Point cyclone of September 22nd, 1885. Rs. 2.*	Sir Alexander Pedlar.
Part III.	On the ground temperature observations made at the old observatory, Allahabad. Rs. 1-8.*	S. A. Hill.
Part IV.	List and brief account of the south-west monsoon storms generated in the Bay of Bengal during the years 1882 to 1886. Rs. 3.*	Sir John Eliot
Part V.	The cyclonic storms of November and December, 1886 in the Bay of Bengal.	Ditto.
	The cyclone of the 25th May to the 2nd June 1881, in the Arabian Sea. Rs. 3.*	F. Chambers.
Part VI.	On temperature and humidity observations made at Allahabad at various heights above the ground. Rs. 1-8.*	S. A. Hill.
Part VII.	The Arabian Sea cyclone of the 4th to the 13th June, 1887.	F. Chambers.
	On the meteorology and climatology of northern Afghanistan. Rs. 1-8.*	W. L. Dallas.
Part VIII.	An account of the more important cold weather storms in India during the years 1876 to 1891. Rs. 3.*	Sir John Eliot.

* Out of print.

INDIAN METEOROLOGICAL MEMOIRS.—(contd.)

Vol. V—

The discussion of the hourly observations made at Sibsagar, Goalpara, Patna, Hazaribagh, Dhubri, Roorkee, Allahabad, Lucknow, Agra, Leh, Deesa, Karachi and Lahore and at Simla. Complete in 10 parts, each part Re. 1.*	Parts I—VII, H. F. Blanford. Parts VIII—X, Sir John Eliot.

Vol. VI—

Part I.	The relation between sunspots and weather as shown by meteorological observations taken on board ships in the Bay of Bengal during the years 1856 to 1879.	W. L. Dallas.
	Investigation into the mean temperature, humidity and vapour tension conditions of the Arabian Sea and Persian Gulf. Rs. 2.*	Ditto.
Part II.	A preliminary discussion of certain oscillatory changes of pressure of long period and of short period in India. Re. 1.*	Sir John Eliot.
Part III.	The hot winds of northern India.*	Ditto.
	An account of a storm developed in equatorial regions. Rs. 2.*	W. L. Dallas.
Part IV.	Hailstorms in India during the period 1883—1897 with a discussion on their distribution. Re. 1.*	Sir John Eliot.
Part V.	A discussion of the anemographic observations recorded at Simla during the period September 1893 to August 1896 and at Darjiling during the period April 1885 to December 1896 and an investigation into the general features of the air movement in the Himalayan mountain area. Re. 1.*	Ditto.
Part VI.	A discussion of the anemographic observations recorded at Darjiling during the period May 1885 to May 1896, and an investigation into the general features of the air movement in the Sikkim Himalayas. Re. 1.	Ditto.
Part VII.	A discussion of the thunderstorm observations recorded in 1897 at ten selected stations in India. Re. 1.*	W. L. Dallas.

Vol. VII—

Hourly observations of pressure, temperature, vapour tension, humidity, cloud, wind direction and velocity of wind taken at Trivandrum during the years 1853 to 1864. Complete in 7 parts, each part Rs. 1-8.*	Sir John Eliot.

Vol. VIII—

Part I.	Hourly meteorological observations recorded at the Agustia observatory during the period from January 1856 to September 1858 and from June to December 1864. Rs. 2.	Ditto.
Part II.	Hourly comparative meteorological observations taken at Trivandrum, Vannatheertham (eastern station) Kalliad (western station) and Agustia for the periods 23rd March to 20th April 1857, 20th January to 19th February 1859, 9th September to 8th October 1864 and 2nd to 28th January 1865, also at Cape Comorin from 23rd September to 13th November 1858 and at Charatha and at Kamala from 20th January to 19th February 1859. Re. 1.	Ditto.

Vol. IX—

The diurnal variation of atmospheric conditions at Chittagong, Cuttack, Jubbulpore, Pachmarhi, Nagpur, Poona, Belgaum, Bellary, Trichinopoly, Rangoon, Aden, Alipore and Jaipur. Complete in 9 parts, each part Rs. 1-8.*	Part I, H. F. Blanford. Parts II—VII, Sir John Eliot. Part VIII, D. Archibald. Part IX, Sir John Eliot.

Vol. X—

Part I.	The discussion of the hourly meteorological observations recorded at Trivandrum during the years 1853—1864. Rs. 3.*	Sir John Eliot.
Part II.	The discussion of the hourly meteorological observations recorded at Agustia during the years 1856—1858 and 1864. Rs. 2.*	Ditto.
Part III.	Discussion of the comparative hourly meteorological observations recorded at Trivandrum, Kalliad, Vannatheertham and Agustia for the periods 23rd March to 20th April 1857, 20th January to 19th February 1859, 9th September to 8th October 1864 and 2nd to 28th January 1865, and at Charatha and Kamala from 20th January to 19th February 1859. Rs. 2.*	Ditto.
Part IV.	Plates I to LVII, title-page, table of contents and corrigenda of Volume X, Parts I, II and III of the Indian Meteorological Memoirs. Rs. 3.*	Ditto.

Vol. XI—

Part I.	Observations recorded during the solar eclipse of 22nd January 1898 at 154 meteorological stations in India. Re. 1.*	Ditto.
Part II.	A discussion of the observations recorded during the solar eclipse of 22nd January 1898 at 154 Meteorological stations in India. Rs. 3.*	Ditto.
Part III.	Report on cloud observations and measurements in the plains of the "North-Western" Provinces of India during the period December 1898 to March 1900. Re. 1.*	E. G. Hill.

Vol. XII—

Part I.	A discussion on the failure of the southwest monsoon rains in 1899. Re. 1.*	W. L. Dallas.
Part II.	A discussion of the results of the hourly observations recorded at 29 stations in India given in Volumes V, IX and X of the Indian Meteorological Memoirs. Rs. 3.*	Sir John Eliot.
Part III.	Discussion of the results of the hourly observations recorded at 29 stations in India given in Volumes V, IX and X of the Indian Meteorological Memoirs (Final chapter and plates). Rs. 3.*	Ditto.
Part IV.	A meteorological history of the seven monsoon seasons 1893—1899, in relation to the Indian rainfall. Rs. 3.*	W. L. Dallas.

Vol. XIII—

Daily normals of maximum temperature, minimum temperature, 8 a.m. air pressure reduced to 32° F. and rainfall; and five-day means of normal cloud amount, relative humidity and aqueous vapour pressure at 8 a.m. Rs. 5.*	Sir John Eliot.

Vol. XIV—

Monthly and annual rainfall of 457 stations in India to the end of 1900. Rs. 3.*	Ditto.

* Out of print.

INDIAN METEOROLOGICAL MEMOIRS.—(contd.)

Vol. XV—

Part I.	Summary and brief discussion of observations of the clouds recorded at six stations in India during the period 1895—1900. Re. 1.*	Sir John Eliot.
Part II.	Report on cloud observations and measurements at Simla during the period June 1900 to January 1902. Re. 1.*	W. L. Dallas.
Part III.	Discussion of monthly mean surface and underground temperatures, deduced from observations taken at Lahore, Jaipur, Dehra Dun, Allahabad and Calcutta during the years 1880—1901. Re. 1.*	R. L. Jones.

Vol. XVI—

Part I.	Monthly means of air-pressure reduced to 32°F. and constant gravity, Lat. 45°. Rs. 3.*	Sir John Eliot.
Part II.	A preliminary investigation of the more important features of the meteorology of Southern Asia, the Indian Ocean and neighbouring countries during the period 1892—1902, with appendices. Rs. 3.	Ditto.

Vol. XVII—

	Normal monthly and annual means of temperature, pressure, wind, humidity, cloud, rainfall and number of rainy days of stations in India and neighbouring countries. Rs. 3.	Ditto.

MEMOIRS OF THE INDIA METEOROLOGICAL DEPARTMENT†.—

Vol. XVIII—

Part I.	A discussion of the anemographic observations recorded at Rangoon from June 1878 to October 1901, and at Chittagong from June 1879 to December 1896. Rs. 2.*	Ditto.
Part II.	A discussion of the anemographic observations recorded at Saugor Island from March 1880 to February 1904, and at Alipore (Calcutta) from March 1877 to February 1904. Rs. 2.	Ditto.
Part III.	A discussion of the anemographic observations recorded at Allahabad from September 1890 to August 1904 and at Lucknow from July 1878 to October 1892. Rs 2.	Ditto.
Part IV.	A discussion of the anemographic observations recorded at Roorkee from September 1879 to August 1904; at Lahore from June 1889 to May 1905; and at Mussooree during May to October from 1877 to 1888. Rs. 2.	Ditto.

Vol. XIX—

Parts I and II.	A discussion of the anemographic observations recorded at Pachmarhi from September 1883 to April 1887, and at Nagpur from January 1882 to December 1902. Rs. 2.	Ditto.
Parts III and IV.	A discussion of the anemographic observations recorded at Port Blair from September 1894 to 1904. A discussion of the anemographic observations recorded at Dhubri from November 1889 to May 1896. Rs. 1-8.	W. A. Harwood.
Parts V and VI.	A discussion of the anemographic observations recorded at Jubbulpore from May 1889 to April 1900. A discussion of the anemographic observations recorded at Belgaum from May 1881 to April 1904. Rs. 1-8.	Ditto.
Parts VII and VIII.	A Discussion of the anemographic observations recorded at Deesa from January 1879 to December 1904. A discussion of the anemographic observations recorded at Karachi from January 1873 to December 1894. Rs. 1-8.*	Ditto.

Vol. XX—

Part I.	An account of the preparations made for determining the conditions of the upper air in India by means of Kites. Re. 1.*	J. H. Field.
Part II.	Kite flights made at Belgaum during the pre-monsoon and monsoon periods in 1916. Re. 1*.	Ditto.
Part III.	The Simla seismograms obtained between June 1905 and November 1908. Rs. 2.*	J. Patterson.
Part IV.	A discussion of types of weather in Madras. Re. 1.*	R. L. Jones.
Part V.	A discussion of some of the anemographic observations recorded at Madras. Re. 1.*	Ditto.
Part VI.	Correlation in seasonal variations of climate. (Introduction.) Re. 1.*	Sir Gilbert T. Walker.
Part VII.	Kite flights in India and over the neighbouring sea areas during 1907. Re. 1.*	J. H. Field.
Part VIII.	On the electricity of rain and its origin in thunderstorms. Rs. 3.*	Sir George C. Simpson.

Vol. XXI—

Part I.	On the meteorological evidence for supposed changes of climate in India. Rs. 1-8.*	Sir Gilbert T. Walker.
Part II.	Correlation in seasonal variations of weather, II. Rs. 1-8.*	Ditto.
Part III.	Data of heavy rainfall over short periods in India. Re. 1.*	Ditto.
Part IV.	On the rapid calculation of times of moonrise and moonset. As. 8.	J. H. Field and S. M. Jacob.
Part V.	The liability to drought in India as compared with that in other countries. As. 8.*	Sir Gilbert T. Walker.
Part VI.	Potential gradient at Simla. As. 8.	Sir G. C. Simpson.
Part VII.	The cold weather storms of northern India. As. 8.*	Sir Gilbert T. Walker and Rai Bahadur Hem Raj.
Part VIII.	A further study of relationships with Indian monsoon rainfall. As. 8.*	Sir Gilbert T. Walker.
Part IX.	Correlation in seasonal variations of weather, III. As. 8.	Ditto.
Part X.	Correlation in seasonal variations of weather, IV, sunspots and rainfall. Rs. 1-8.	Ditto.
Part XI.	Correlation in seasonal variation of weather, V, sunspots and temperature. Re. 1.*	Ditto.
Part XII.	Correlation in seasonal variation of weather, VI, sunspots and pressure. Re. 1.	Ditto.
Part XIII.	On the Calcutta standard barometer. Re. 1.*	E. P. Harrison.
Part XIV.	Correlation of rainfall and the succeeding crops with special reference to the Punjab. Re. 1.*	S. M. Jacob.

Vol. XXII—

Part I.	Monthly and annual rainfall normals. Rs. 1-8.	Sir Gilbert T. Walker.
Part II.	Monthly and annual normals of number of rainy days. Rs. 1-8.	Ditto.
Part III.	Monthly and annual normals of pressure, temperature, relative humidity, vapour tension and cloud. Rs. 1-8.*	Ditto.
Part IV.	On winds at ground level and above at nine stations in India. Rs. 2.	J. H. Field.
Part V.	Cloud observations made in India between 1877 and 1914. Re. 1.	W. A. Harwood.
Part VI.	On dust-raising winds and descending currents. As. 8.	E. H. Hankin.
Part VII.	On dust-raising winds. As. 8.	C. W. B. Normand.

* Out of print.

† The Indian Meteorological Memoirs are styled by this name from Vol. XVIII.

MEMOIRS OF THE INDIA METEOROLOGICAL DEPARTMENT.—(contd.)

Vol. XXIII—

Part I.	Wet bulb temperatures and the thermodynamics of the air. Re. 1.	C. W. B. Normand.
Part II.	Correlation in seasonal variations of weather, VII, the local distribution of monsoon rainfall. Re. 1.	Sir Gilbert T. Walker
Part III.	Mean monthly character of upper air winds deduced from the flights of pilot balloons at thirteen stations in India during the period 1910 to 1919. Rs. 2.	J. H. Field.
Part IV.*	The effects of oscillations and of "lag" on the readings of the Kew pattern barometer. Re. 1.	E. P. Harrison.
Part V.	On clearing and refilling various types of barometer, together with a description of several usual patterns. Rs. 1-8.	Ditto.
Part VI.	On Indian monsoon rainfall in relation to south American weather, 1875—1914. Rs. 2.	R. C. Mossman.
Part VII.	Monthly and annual normals of rainfall and of rainy days. Rs. 7-12.*	Sir Gilbert T. Walker.
Part VIII.	Frequency of heavy rain in India. Rs. 3-14.	Ditto.

Vol. XXIV—

Part I.	On the seat of activity in the upper air. Re. 1.	P. C. Mahalanobis.
Part II.	On errors of observation and upper air relationships. Re. 1.	Ditto.
Part III.	On exposure of thermometers in India. Rs. 1-8.	J. H. Field.
Part IV.	Correlation in seasonal variations of weather, VIII, preliminary study of world weather. Rs. 2.	Sir Gilbert T. Walker.
Part V.	The free atmosphere in India, introduction. Rs. 1-12.*	J. H. Field.
Part VI.	The free atmosphere in India, observations with kites and sounding balloons up to 1918. Rs. 1-8.	W. A. Harwood.
Parts VII & VIII.	The free atmosphere in India— (*vii*) Heights of clouds and directions of free air movement.* (*viii*) Upper air movement in the Indian monsoon and its relation to the general circulation of the atmosphere. Rs. 1-14.	Ditto.
Part IX.	Correlation in seasonal variations of weather, IX, a further study of world weather. Rs. 2-12.	Sir Gilbert T. Walker.
Part X.	Correlation in seasonal variations of weather, X, applications to seasonal forecasting in India. As. 8.	Ditto.
Part XI.	Rainfall types in India in the cold weather period, December to March 1915. As. 4.	Sir Gilbert T. Walker and T. C. Kamesvara Rao.

Vol. XXV—

Part I.	Sky illumination at sunrise and sunset. As. 10 or 1*s.**	K. R. Ramanathan.
Part II.	Summary of Indian rainfall for the fifty years, 1875—1924. Rs. 8 or 13*s.* 6*d.*	Departmental.
Part III.	Data of heavy rainfall over short periods in India. Rs. 2-2 or 4*s.*	Ditto.
Part IV.	Correlation between weather and crops with special reference to Punjab wheat. Re. 1 or 1*s.* 9*d.**	M. V. Unakar.
Part V.	Discussion of results of sounding balloon ascents at Agra during the period July 1925—March 1928 and some allied questions. Rs. 2 or 3*s.* 6*d.**	K. R. Ramanathan.
Part VI.	The wind at Agra and its structure. Rs. 2-14 or 5*s.*	Barkat Ali.
Part VII.	An analysis of the base line values of autographic instruments. Re. 1-4 or 2*s.**	S. K. Banerji.
Part VIII.	The lunar atmospheric tide at Bombay. As. 10 or 1*s.**	S. K. Pramanik.
Part IX.	Evaporation and its measurement (First Paper). Rs. 2 or 2*s.* 6*d.**	S. K. Banerji and H. M. Wadia.
Part X.	Solar radiation measurements at Poona in 1931. As. 12 or 1*s.* 3*d.**	S. S. Kohli.

Vol. XXVI—

Part I.	Registration of earth-current with natural electrodes. Rs. 1-6 or 2*s.* 3*d.**	S. K. Banerji.
Part II.	The Indian southwest monsoon and the structure of depressions associated with it. Rs. 2-10 or 4*s.* 9*d.**	K. R. Ramanathan and K. P. Ramakrishnan.
Part III.	On the physical characteristics of fronts during the Indian southwest monsoon. Rs. 1-9 or 2*s.* 9*d.**	N. K. Sur.
Part IV.	Discussion of results of sounding balloon ascents at Poona and Hyderabad during the period October 1928 to December 1931. Rs. 2-8 or 4*s.* 6*d.**	K. R. Ramanathan & K. P. Ramakrishnan.
Part V.	Soundings of temperature and humidity in the field of a tropical cyclone and a discussion of its structure. Rs. 1-6 or 2*s.* 3*d.**	K. R. Ramanathan.
Part VI.	Typhoons and Indian weather. Rs. 1-10 or 2*s.* 9*d.**	V. Doraiswamy Iyer.
Part VII.	Latent instability in the atmosphere revealed by some Indian tephigrams. Re. 1-8 or 2*s.* 6*d.**	V. V. Sohoni and (Miss) M. M. Paranjpe.
Part VIII.	Measurements of the radiation from the Sun and the sky at Poona in 1935. Re. 1-4 or 2*s.**	P. K. Raman.
Part IX.	Discussion of results of soundings of temperature and humidity at Jhikargacha (Bengal) in April and May 1929. Rs. 1-8 or 2*s.* 3*d.**	G. Chatterjee and N. K. Sur.
Part X.	The general circulation of the atmosphere over India and its neighbourhood. Rs. 10-8 or 16*s.* 6*d.**	K. R. Ramanathan & K. P. Ramakrishnan.

Vol. XXVII—

Part I.	A study of the duststorms of Agra. Rs. 1-12 or 2*s.* 6*d.*	B. N. Sreenivasaiah and N. K. Sur.
Part II.	Discussion of results of sounding balloon ascents at Madras in the months of June to November 1932—1935. As. 14 or 1*s.* 3*d.*	N. K. Sur and K. P. Ramakrishnan.
Part III.	The climate of Sceychelles with special reference to its rainfall. Rs. 1-2 or 1*s.* 9*d.*	V. Doraiswamy Iyer and K. A. Francis.
Part IV.	On the thermal structure of the atmosphere over Agra. Rs. 2 or 3*s.* (1948).	R. Ananthakrishnan.
Part V.	Monthly and annual normals of rainfall and of rainy days based on records up to 1940. Rs. 8 or 13*s.* (1949).	Departmental.
Part VI.	A report on the rainfall studies made in connection with the unified development of the Damodar River. Rs. 5-4 or 8*s.* 3*d.* (1949).	V. Satakopan.

Vol. XXVIII—

Part I.	General characteristics of squalls at Peshawar. Rs. 7-8 or 11*s.* 6*d.* (1950).	C. Ramaswamy and K. C. Majumdar.
Part II.	The upper winds at 10 Kms. and above over India and its neighbourhood. Rs. 23-8 or 36*s.* (1950).	S. P. Venkiteshwaran.
Part III.	Rainfall at Peshawar. Rs. 3-6 or 5*s.* 6*d.* (1950).	C. Ramaswamy and N. Suryanarayana.
Part IV.	Notes on analysis of weather of India and neighbourhood. Rs. 5-2 or 8*s.* (1950).	S. L. Malurkar.

* Out of print.

MEMOIRS OF THE INDIA METEOROLOGICAL DEPARTMENT.—(contd.)

Vol. XXVIII—(contd.)

Part V.	On the development and structure of monsoon depressions in India. Rs. 2-4 or 3*s.* 9*d.* (1951).	B. N. Desai.
Part VI.	A study of hourly rainfall at Mingaladon Airport (Burma). Rs. 3-10 or 5*s.* 9*d.* (1951).	S. S. Lal.

Vol. XXIX—

Part I.	An investigation into the variation of the lapse rate of Temperature in the atmosphere near the ground at Drigh Road, Karachi. Rs. 2-2 or 3*s.* 6*d.*	Mal, Desai and Sircar.
Part II.	Discussion of Upper air data obtained from aeroplane Meteorological flights over Peshawar and Quetta during the years 1927—36. Rs. 2-12 or 4*s.* 6*d.*	R. Ananthakrishnan.
Part III.	Squalliness of monsoon showers at Juhu (Bombay). Rs. 3 or 5*s.* (1952).	P. A. George.
Part IV.	Hydrometeorology of Koyna Catchment. Rs. 5-4 or 8*s.* 3*d.* (1952).	S. K. Pramanik and K. N. Rao.
Part V.	Equivalent and Equivalent Potential Temperatures. Rs. 7-4 or 11*s.* 6*d.* (1953).	K. N. Rao.
Part VI.	Hydrometeorology of Damodar Catchment. Rs. 13-2 or 20*s.* 6*d.* (1953).	S. K. Pramanik and K. N. Rao.

Vol. XXX—

Part I.	Rainfall of Madras State with special reference to Tamilnad and Rayalaseema (in Press).	P. R. K. Rao.
Part II.	Hydrometeorology of Mayurakshi Catchment (in Press).	S. K. Pramanik and K. N. Rao.

IX. KODAIKANAL OBSERVATORY BULLETINS.—

Nos. I to VIII, XIII, XIV, XVII, XIX, XXI and XXIII. Each As. 8.	C. M. Smith.
Nos. IX to XII, XV, XVIII, XX, XXII, XXIV to XXXII, XXXVI, XLI, XLII, XLV, LI, LV, LVIII to LXII, LXIV, LXV, LXVIII, LXIX and LXXII.	J. Evershed.
No. XVI.	Sir Gilbert T. Walker.
Nos. XXXIII, XXXIV, XXXVII, XXXVIII, XL, XLIII, XLVII, XLVIII, L, LII, LIII, LIV, LVI, LVII, LXIII, LXV, LXVI, LXX, LXXI, LXXIII to LXXV, LXXVIII to LXXXI, LXXXIII to LXXXV, LXXXVIII to XC, XCII, XCIV, XCV, C, CII to CVII and CX.	T. Royds.
No. XXXV.	T. Royds and S. Sitarama Ayyar.
Nos. XXXIX and XLIX.	J. Evershed and T. Royds.
Nos. XLIV, LXXVI and LXXVII.	A. A. Narayana Ayyar.
No. XLVI.	J. Evershed and A. A. Narayana Ayyar.
No. LXVII.	J. Evershed and P. R. Chidambara Iyer.
No. LXXXII.	P. R. Chidambara Iyer.
Nos. LXXXVI, LXXXVII, XCIX.	A. L. Narayan.
No. XCI.	A. S. Rao.
No. XCIII.	G. V. Krishnaswamy.
No. XCVI.	M. Salaruddin.
No. XCVII.	P. R. Chidambara Iyer.
Nos. XCVIII, CVIII.	Departmental.
No. CI.	C. P. S. Menon.
No. CIX.	T. Royds and A. L. Narayan.
No. CXI.	T. Royds and M. Salaruddin.
No. CXVIII.	A. L. Narayan.
No. CXIX.	A. K. Das.
Nos. CXX to CXXV	Departmental.
No. CXXVI.	A. K. Das and N. Rajeswara Rao.
No. CXXVII	A. K. Das and K. Setumadhavan.
No. CXXVIII.	Departmental.
No. CXXIX.	Ditto.
No. CXXX.	Ditto.
No. CXXXI.	Ditto.
Supplement to No. CXVIII.	Ditto.
Supplement to No. CXIX.	

X. MEMOIRS OF THE KODAIKANAL OBSERVATORY.—

Vol. I—

Part I.	The Spectrum of Sunspots. Rs. 1-8.	J. Evershed.
Part II.	Results of prominence observations. Rs. 2.	J. Evershed and Mary A. Evershed.

XI. PUBLICATIONS CONTAINING MAINLY DATA.—

Bombay Magnetic Data—

Magnetic, meteorological and seismological observations made at the Government Observatory, Bombay—
1845-97.*
1898-99. Rs. 5-8.†
1900-01. Rs. 4-8.

* Only volumes for 1891, 1892 and 1896 are available. The rest are out of print.

† Out of print.

PUBLICATIONS CONTAINING MAINLY DATA.—(contd.)

Bombay Magnetic Data—(contd.)

Magnetic, meteorological, and seismological observations made at the Government Observatories, Bombay and Alibag—

1902—05.	Rs. 14-10.	Departmental.
1906—10.	Rs. 15-0.	
1911—15.	Rs. 19-0	
1916—20.	Rs. 27-8.	
1921.	Rs. 9-12 or 16*s.*	
1922.	Rs. 7-6 or 11*s.* 9*d.*	
1923.	Rs. 8-8 or 14*s.* 3*d.*	
1924.	Rs. 6 or 11*s.*	
1925.	Rs. 9-12 or 16*s.*	
1926.	Rs. 10-12 or 17*s.* 6*d.*	
1927.	Rs. 10-12 or 17*s.* 6*d.*	
1928.	Rs. 14 or 22*s.* 6*d.*	
1929.	Rs. 12 or 19*s.* 6*d.*	
1930.	Rs. 12-4 or 20*s.*	
1931.	Rs. 12-6 or 20*s.*	
1932.	Rs. 13-14 or 22*s.* 6*d.*	
1933.	Rs. 11 or 18*s.*	
1934.	Rs. 11-4 or 17*s.*	
1935.	Rs. 9-14 or 16*s.* 6*d.*	
1936.	Rs. 11 or 17*s.* 3*d.*	
1937.	Rs. 14-14 or 23*s.*	

Magnetic, meteorological, atmospheric, electric and seismographic observations made at the Government Observatories, Bombay and Alibag—

1938.	Rs. 9-8 or 15*s.*	Departmental.
1939.	Rs. 14-14 or 23*s.*	
1940.	In the press.	
1941.		
1942.		
1943.		
1944.		

Colaba Magnetic Data. 1846—1905, Part I. Rs. 15.	N. A. F. Moos.
Colaba Magnetic Data. 1846—1905, Part II. Rs. 30.	Ditto.

India Weather Review—

Annual Summaries for the years 1891—1920 (30 Parts). Each Rs. 2.‡	Departmental.

1921-22.	Each Rs. 11-4.	Departmental.
1923.	Rs. 12-8 or 20*s.*	
1924.	Rs. 8-12 or 14*s.* 6*d.*	
1925.	Rs. 10-2 or 16*s.* 9*d.*	
1926.	Rs. 13-12 or 22*s.*	
1927.	Rs. 10-12 or 17*s.* 6*d.*	
1928.	Parts A to G.	Each Part priced separately.
1929.	Introduction and Parts A to F.	
1930.	Ditto.	
1931.	Ditto.	
1932.	Ditto.	
1933.	Introduction and Parts A to D.	
1934.	Ditto.	
1935.	Ditto.	
1936.	Ditto.	
1937.	Ditto.	
1938.	Introduction and Parts A to C.	
1939.	Ditto.	
1940.	Ditto.	
1941.	Ditto.	
1942.	Ditto.	
1943.	Ditto.	
1944.	Ditto.	
1945.	Ditto	
1946.	Ditto.	
1947.	Ditto.	
1948.	Part B (Part A in Press and Part C).	
1949.	Part B.	

Rainfall Tables—

(i)	Daily Rainfall of India for the years 1891—1922 (32 volumes, Rs. 9 a volume). †	Departmental.
	Daily Rainfall of India for the years 1923—24, each Rs. 10-12 or 17*s.* 6*d.*	Ditto.
	Daily Rainfall of India for the years 1925—1945, each volume Rs. 68-8.	Ditto.
(ii)	Monthly Rainfall of India, 1901—1922 (22 volumes). Rs. 2 a volume.	Ditto.
	Monthly Rainfall of India 1923—24, each volume Rs. 2-8 or 4*s.* 6*d.*	Ditto.
	Monthly Rainfall of India 1925—1945, each volume Rs. 16-9.	Ditto.
(iii)	Rainfall of the Bombay Presidency for the years previous to 1891. Vols. I—VI. Rs. 5-12 to Rs. 6-8.	N. A. F. Moos.

Memorandum on the rainfall and other Weather conditions of India (Annual).	Departmental.

Monthly Weather Reviews and Reports—

(i)	Monthly Weather Reviews for each month, January 1891 to December 1920, each As. 12.*	Ditto.
(ii)	Monthly Weather Report.	Ditto.

Weekly Weather Reports—

Weekly Weather Report, published in Poona. Monthly subscription Re 1.	Ditto.

Daily Weather Reports—

India Daily Weather Report, published in Poona. Monthly subscription Rs. 3 without evening chart and Upper Air Report. (Rs. 5 complete.)	Ditto.

* Some issues are out of print.

† Volumes for 1891, 1914 to 1924, 1932 to 1937 are out of print.

‡ Volumes for 1902—1906, 1910 and 1912—1917 are out of print.

PUBLICATIONS CONTAINING MAINLY DATA—(contd.)

Regional Weather Reports for—

Bombay, Calcutta, Madras, Nagpur, New Delhi — Monthly subscription Rs. 2 for each region.

Upper Air Data—

(i)	Upper Air Data Parts 1—14 (1928 to 1935) each part priced Rs. 4-4 or 7*s*.	Departmental.
(ii)	Upper Air Data Part A (1936—1943) each issue priced separately.	Ditto.
(iii)	Upper Air Data Part B (1936—1940) and 1942 and 1943 each issue priced separately.	Ditto.

Seismological Bulletins—

(i)	Seismological Bulletins, Quarterly. (1938—1942)		Ditto.
(ii)	Seismological Bulletins, 1946, 1947 (roneoed)		
	1943 January—March		
	1943 July—September	Quarterly.	Ditto.
	1944 January—March		
(iii)	Seismological Bulletins, 1948 January and February		
	1950		Ditto.
	1951 January to July	Monthly(roneoed).	

XII. SEASONAL FORECASTS.—

(i) Memorandum on the probable amount of rain and snow in Northwest India in January, February and March.
(ii) Memorandum regarding the probable amount of monsoon rainfall.
(iii) Memorandum on the rainfall of June and July and the probable amount during August and September.
(iv) Statement of the Rainfall and snowfall of Northwest India in January, February and March.
(v) Statement of actual rainfall in the monsoon season, June to September.

XIII. REPORT ON THE ADMINISTRATION OF THE METEOROLOGICAL DEPARTMENT OF THE GOVERNMENT OF INDIA (ANNUAL).—

(i) Annual Report of the Director General of Observatories on the observatories of Kodaikanal, Madras, Bombay and Alibag, accompanying their Annual Reports. As. 8.
(ii) Report on the administration of the Meteorological Department of the Government of India.
(iii) Report of the Kodaikanal Observatory 1922—1950.

XIV. INDIAN JOURNAL OF METEOROLOGY AND GEOPHYSICS (QUARTERLY).—

Vol. 1—

No. 1. January 1950. Rs. 2-6 or 4*s*.
No. 2. April 1950. Rs. 2-4 or 3*s*. 9*d*.
No. 3. July 1950. Rs. 2-4 or 3*s*. 9*d*.
No. 4. October 1950. Rs. 1-14 or 2*s*. 9*d*.

Vol. 2—

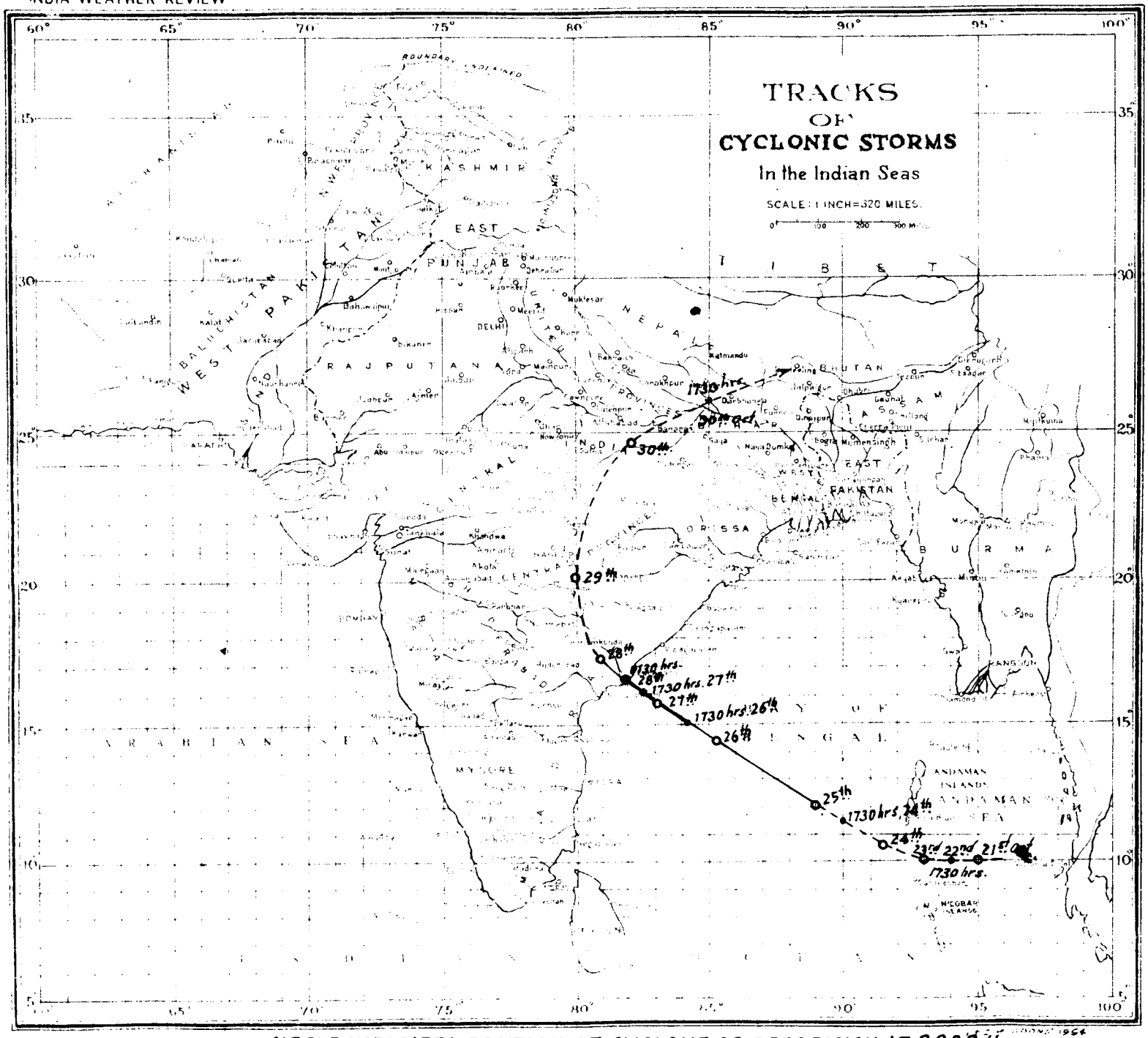
No. 1. January 1951. Rs. 2-6 or 4*s*.
No. 2. April 1951. Rs. 2-4 or 3*s*. 9*d*.
No. 3. July 1951. Rs. 2-4 or 3*s*. 9*d*.
No. 4. October 1951. Rs. 1-14 or 2*s*. 9*d*.

Vol. 3—Onwards.

Rs. 2-8 or 4*s*. per issue. Annual Subscription Rs. 10 or 16*s*.

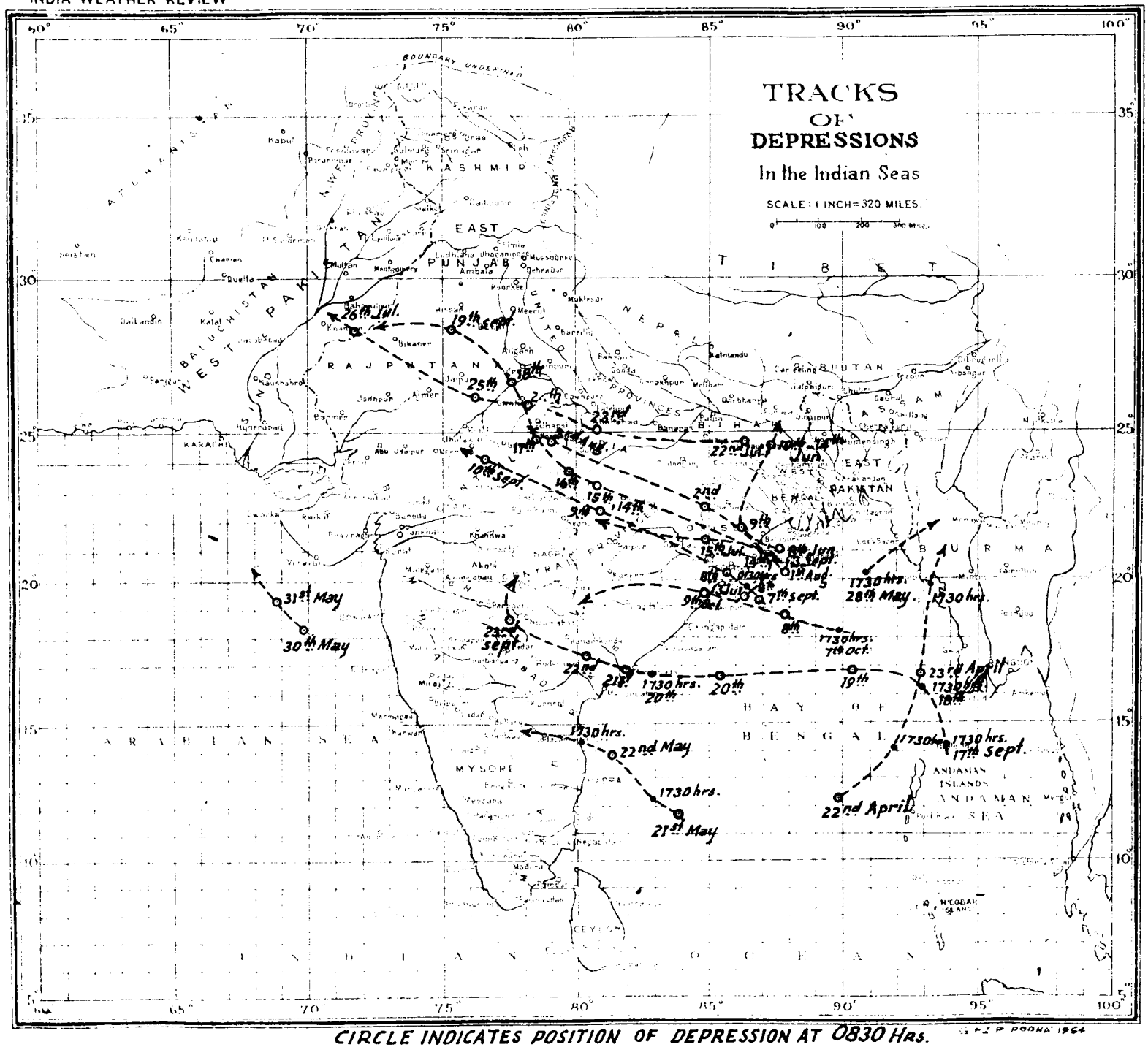
Departmental.

GIPN—S1 108 DDGOB Poona—3-5-54—609



CIRCLE INDICATES POSITION OF CYCLONE OR DEPRESSION AT 0830 Hrs.

-------- Depression ———— Storm ———— Severe Storm



CIRCLE INDICATES POSITION OF DEPRESSION AT 0830 Hrs.

S.K.I.P. POONA 1964